

VEGETABLE GROWING PROJECTS

WATTS



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VEGETABLE GROWING PROJECTS

MACMILLAN AGRICULTURAL PROJECT SERIES

EDITED BY

RUFUS W. STIMSON

Supervisor of Vocational Agricultural Education in Massachusetts

VOCATIONAL AGRICULTURAL EDUCATION

By RUFUS W. STIMSON

VEGETABLE GROWING PROJECTS

By RALPH L. WATTS

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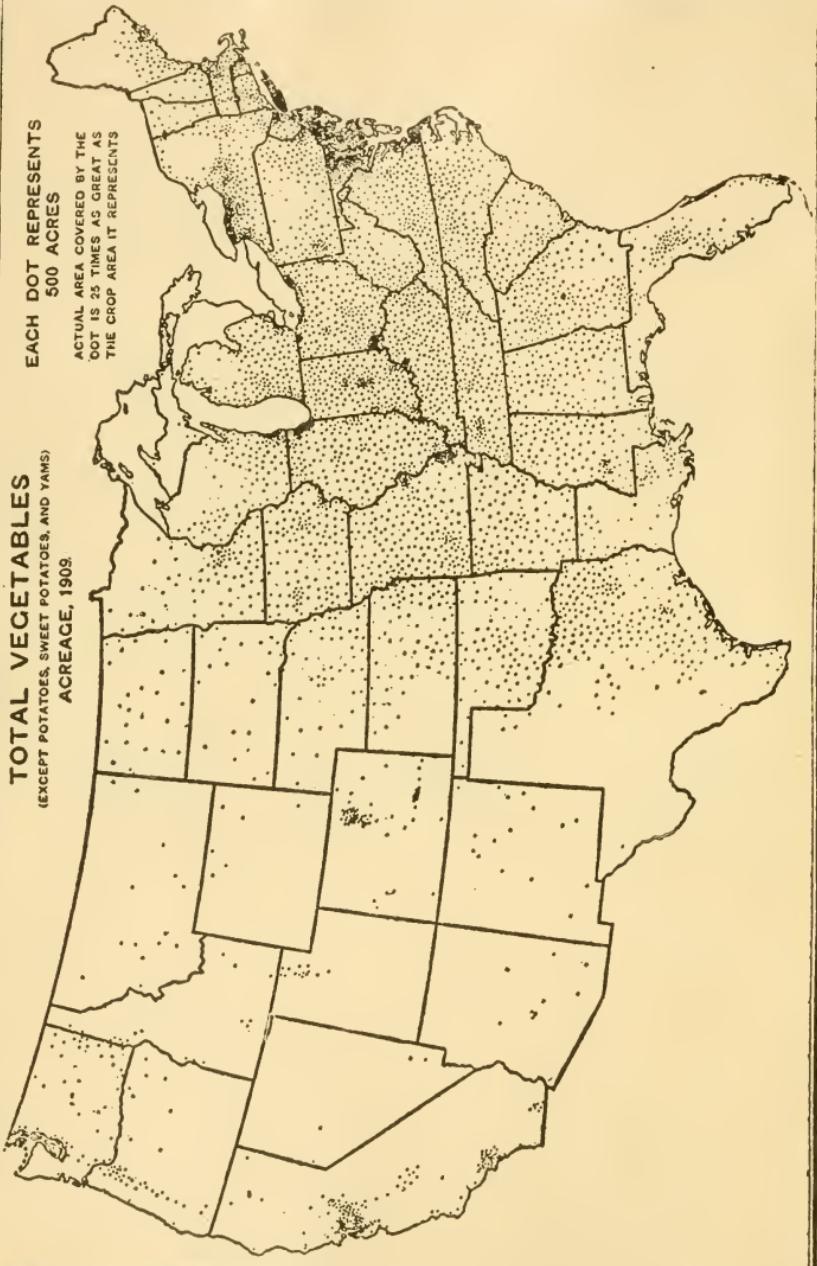
For Combining
Earning and Learning

Study
Guide-Books

TOTAL VEGETABLES
(EXCEPT POTATOES, SWEET POTATOES, AND YAMS)
ACREAGE, 1909.

EACH DOT REPRESENTS
500 ACRES

ACTUAL AREA COVERED BY THE
DOT IS 25 TIMES AS GREAT AS
THE CROP AREA IT REPRESENTS



Map showing vegetable growing industry in the United States.

VEGETABLE GROWING PROJECTS

BY

RALPH L. WATTS

Dean and Director of the School of Agriculture and Experiment Station of The Pennsylvania State College, and author
of *Vegetable Gardening*, *Vegetable Forcing*,
and *The Vegetable Garden*



New York

THE MACMILLAN COMPANY

1922

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Set up and electrotyped. Published April, 1922.

Norwood Press
J. S. Cushing Co. — Berwick & Smith Co.
Norwood, Mass., U.S.A.

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EDITOR'S PREFACE

This is a handbook for progressive vegetable growers.

It is a reliable and up-to-date rule-book for both home gardening and market gardening. It springs from Pennsylvania, a state great in gardening owing to nearness to big cities and their markets; and Dean Watts, its author, is an experienced and widely recognized authority in these fields.

It is, also, a guidebook for studying vegetable growing thoroughly from all angles,—practical and technical, managerial and scientific. It applies principles set forth in *Vocational Agricultural Education*, the first book of this "Project Series." By its open spacing, it offers a convenient framework for listing local problems, questions, and plans. This open spacing should assist in keeping *help* and *self-help* of the learner in desirable balance. It should make the learner at once critical and self-reliant.

The open-spaced "Calendar" of activities, in particular, should lighten the labors of effective planning for both gardener and teacher. The author, in his "Explanations and Suggestions," has not overstated the importance of the reciprocally beneficial processes of doing as an aid to learning, and of learning as an aid to doing; nor, of choice of the proposed project at the outset, in order that every move may be made to count toward its successful outcome as an enterprise that is to be both productive and educational. The "Calendar" outlines summer study under field conditions, as well as study during the usual school year.

A set of supplementary loose-leaf guide sheets, for gardening field trips, and surveys, group practicums and individual assignments, laboratory activities, accounting and business forms, has

been prepared by Director G. H. Gilbert of Bristol County Agricultural School, Segreganset, Massachusetts. It is the outgrowth of experience at an excellent school that distributes instruction over projects carried on with the aid of pupils by the school itself, projects owned and carried on by selected pupils at the school, supervised agricultural work of pupils on projects of other approved farms, and home projects. This should be an aid to valuable notebook work the year around.

This handbook, and its supporting loose-leaf guides, are intended primarily for pupils in vocational agricultural classes of high schools and of separate, county, district, and state schools that are benefiting from federal funds under the so-called Smith-Hughes Act.

The serious questions and problems, practicums, and individual guidance involved may well be given careful attention by students in agricultural teacher-training classes, for there is no greater need in agricultural education than that of preparing would-be instructors for their prospective duties in detail.

There can be no doubt that vocational agricultural pupils of good ability who cover the ground indicated by this handbook should have no difficulty, while preparing first for pleasant and profitable gardening, in earning, at the same time, at least one unit of credit toward entrance into a degree course at any state agricultural college.

RUFUS W. STIMSON.

JANUARY 1, 1922.

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EXPLANATIONS AND SUGGESTIONS

Program of work. — The project method of teaching requires a definite program for the year's work. There should be a thorough understanding and agreement between the pupil and the instructor of the work to be undertaken. To this understanding and agreement the parent, guardian, or employer should be a coöperating party. A decision must be reached at the beginning of the school year regarding the projects to be carried through, and the major features in the program of work should be decided upon as soon as possible thereafter. No one program is suitable for all schools or for all individuals within a given school. Each pupil should prepare a program of work that will be of maximum benefit to himself in the acquirement of skill in, and of knowledge relating to, practical gardening. The skeleton program or "Calendar" in Chapter One should be of help in his program making. This is decidedly a "doing" book. Gaining the most helpful information about vegetable growing will depend upon the actual performance of real operations with real purpose.

Selection of projects. — The selection of projects is the first and fundamental step in making up a program of work. The minor features of the program cannot be determined until this question has been settled. Should each pupil have one or more projects? Should he select Project XXI, Making the Home Garden, with the sole purpose of supplying the home table? Should he conduct one or more projects for commercial purposes? Or, should he combine a model home garden with one or more cash crop projects?

If markets are available, we would urge the undertaking of one or more projects as a business proposition, with the idea of

making the greatest possible profit. Such a motive will be a constant incentive. It will stimulate interest and thoroughness. Ordinarily, it is best not to undertake more than two or three cash crop projects, though there are exceptions. If the market is very limited, then it may be desirable to grow a diversity of crops, but a large number of crops or projects increases the economic risks and the difficulty of the work. It is preferable to master thoroughly the culture of a few crops together with the essentials of advertising, marketing, and accounting.

The business projects to be chosen should be determined by the personal preferences of the pupils and their parents, by the markets available, by the adaptation of soil and climate to the crops under consideration, by the equipment, and by the area of land that can be used.

If possible, Project I, Growing Tomatoes, should be chosen, because of the varied uses and demands for the product and because the questions following each sectional discussion relate to the science of tillage, hardening plants, combating insects, etc., as well as to the practical phases of each operation. Project I might be considered, for study and practice purposes, as the basic project of this text. All other projects contain frequent references to this project. An excellent plan in choosing cash crops would be to select Project I and one or more other projects that are desirable.

Project XXI, Making the Home Garden, should appeal to many students who do not have the advantage of good markets or who may not care to produce vegetables for commercial purposes. Every farm should have a model home garden as an aid to a varied, well-balanced, and attractive diet. We are only beginning to appreciate the vitamine values of garden vegetables.

Project outline.—Every student should prepare a complete project plan. The basis for such a plan will be found in the "Calendar" and questions following each sectional discussion. Many other questions may be added in almost every instance, and ad-

ditional references should be included. Liberal open spacing has been allowed for supplementary questions, references, and notes of local importance.

Principles as well as practice. — In following the project method of teaching, it is exceedingly important to acquire a thorough understanding of the principles involved, as well as the practice essential to success. A knowledge of principles is the greatest aid in the proper performance of every operation. There is almost no limit to which the instructor and gardener may not go in the studying of principles. We should have as complete knowledge as possible of the related sciences of botany, chemistry, physics, and bacteriology, as they apply to the practice of vegetable gardening. Instructors should give special attention to this phase of project teaching.

Accounts. — All projects should be handled as business propositions; careful accounts should be kept of all transactions. The gardener should know at the end of the season the exact costs for fertilizer, seeds, supplies of all kinds; and also the cost of labor, placing a value on his own time, and the cost of marketing. He will then be able to determine the profits realized on the projects. As a student he will thus gain valuable training and experience in bookkeeping and in interpretation of farming figures.

Records. — A complete record should be kept of all operations. From the teaching standpoint alone, too much emphasis cannot be placed on the importance of detailed records. If further vegetable gardening is attempted any time in the future, the records will be found to be of great value. Photographic records of the accomplishments are of special interest.

Reports. — Pupils should make written reports of their work from time to time, and upon the completion of each project a complete report on the year's work should be filed in the school library.

Laboratory exercises. — Instructors will find it necessary to conduct certain laboratory exercises, in addition to the regular project work. These may be soil studies, germination tests,

botanical investigations of vegetables, seed sowing, transplanting, studies of injurious insects and plant diseases, spraying, etc. Every instructor should prepare a schedule of such laboratory exercises as a means of adding interest, understanding, and zest to regular project work. The Gilbert "Guides" referred to in the "Calendar" should be useful in this connection.

Practicums. — Instructors will find that it is important to conduct certain practicums, or work affording preliminary practice, under the closest supervision. In most instances the project plantings will be made at the homes of the pupils, but a certain amount of practice work for the class as a whole, either at the school or at some other convenient point, is almost indispensable as a means of avoiding many mistakes. It is much more effective to show a pupil how to set plants or sow seed than to tell him, and some operations can be shown a small group almost as effectively as an individual. There can be all sorts of simple demonstration work by the instructor in the schoolroom and outdoors. It may be best, in some localities, to maintain a demonstration garden at the school, where most of the operations may be performed in advance of the work at the homes.

Inspection trips. — Inspection trips to the market gardens and the gardens of the pupils should be taken occasionally. A study of well-conducted commercial operations, early in the year, will be found especially helpful.

Exhibits. — Exhibits of the products grown should be made when the crops are in best condition to be shown. Vegetable displays, when skillfully managed, always stimulate community interest in the work of the school, and they are also of great educational value to the pupils.

Judging vegetables. — A thorough knowledge of vegetables is best obtained by judging them. This work should be done as a regular laboratory exercise and also in connection with exhibits. Score cards or instructions for scoring may be obtained from the

United States Department of Agriculture and also from the Agricultural Colleges.

Early plants — where to grow them. — It is not feasible or even possible for all pupils to grow their own plants at their homes. In many schools, it is probably best to make hotbeds and cold frames at the school, under the direction of an instructor who will also supervise the growing of the plants. Each pupil can have whatever space is needed and then the plants may be taken to the homes and set out at the proper time. There are many arguments in favor of this plan.

A special explanation. — In Root Crop Project XII, there is almost an entire absence of references, except cross references in this volume. This is due to the fact that there are so many root crops that a multiplicity of references would be necessary to cover the entire field. Pupils will readily find the information desired in references C, L, and W-VG (see Reference Key), and in the numerous bulletins that are available. The same may be said of Project XXI, Making the Home Garden.

How to use this book. — This book is intended to serve as a guide in studying and conducting vegetable gardening projects. The mind of the pupil should be concentrated on the thing to be accomplished. All effort in seeking information should be centered, for the time being, on this one thing. In no instance should the chapter be studied as chapters are usually studied. The sections, indicated by numbers, are natural divisions of the projects and each section raises a number of questions that should be answered before proceeding with that part of the project.

Only the most salient points are discussed in this book and it is expected that students will make free use of the vast amount of literature relating to vegetable gardening.

REFERENCE KEY

Reference books. — In all references used in this book, letters are employed instead of the titles of the books. The letter W always means this particular book, *Vegetable Growing Projects*, and the numerals used with W refer to the page number. For example, W : 14 refers to this book, page 14; W-VG : 10 refers to *Vegetable Gardening* by Watts, page 10; L : 25 to *Productive Vegetable Gardening* by Lloyd, page 25; and C : 50 to *Garden Farming* by Corbett, page 50, etc. Many other books might be included, but the list is sufficiently complete to meet the needs of most pupils. In fact, if funds are very much limited, the last three volumes named above, or any one of them, with the first, will serve the purpose. SH refers to Stevens and Hall's *Diseases of Economic Plants*, Revised Edition, 1921.

A Allen, C. L. — *Cabbages, Cauliflower, etc.*; The Orange Judd Company

B Beattie, W. R. — *Celery Culture*; The Orange Judd Company

C Corbett, L. C. — *Garden Farming*; Ginn and Company

CL Crosby, C. R., and Leonard, M. D. — *Manual of Garden Insects*
 The Macmillan Company

Fi Fitz, James — *Sweet Potato Culture*; The Orange Judd Company

S-B Sevey, G. C. — *Bean Culture*; The Orange Judd Company

S-P Sevey, G. C. — *Peas and Pea Culture*; The Orange Judd Company

Sp Spillman, W. J. — *Farm Science*; World Book Company

SH Stevens, F. L., and Hall, J. G. — *Diseases of Economic Plants*; The Macmillan Company, 1921

St Stimson, R. W. — *Vocational Agricultural Education by Home Projects*; The Macmillan Company

Tra Tracey, W. W. — *Tomato Culture*; The Orange Judd Company

Trp Troop, J. — *Melon Culture*; The Orange Judd Company

V Vivian, A. — *First Principles of Soil Fertility*; The Orange Judd Company

W Watts, R. L. — *Vegetable Growing Projects*; this book

W-VF Watts, R. L. — *Vegetable Forcing*; The Orange Judd Company

W-VG Watts, R. L. — *Vegetable Gardening*; The Orange Judd Company

Wi Wilkinson, A. E. — *Sweet Corn*; The Orange Judd Company

Bulletins and other references. — Large numbers of bulletins, circulars, and reports of the various agricultural colleges and agricultural experiment stations and of the United States Department of Agriculture, relating to vegetable gardening, may be obtained free of charge upon request. It did not seem desirable to include any of them in the list of references; because in so many instances the supply is soon exhausted and possibly replaced by new editions. Every possible effort should be made to secure such bulletins, circulars, and reports as will be valuable in conducting project work, and letters for references should be assigned for the sake of convenience. Additions of suitable books on vegetable gardening topics should also be made to the school library from time to time.

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ACKNOWLEDGMENTS

THE author desires to acknowledge the valuable assistance of Mr. Rufus W. Stimson, editor of the series of which *Vegetable Growing Projects* is to be a part. We are indebted to him for suggesting the particular form used in the preparation of the manuscript. The author is also grateful to Prof. John R. Bechtel, in charge of vegetable growing instruction at The Pennsylvania State College, who read all the manuscript and who directed the making of most of the illustrations, which were obtained from the Department of Horticulture; to Prof. Raymond G. Bressler, of The Pennsylvania State College, who also read the entire manuscript; to Prof. E. L. Nixon of The Pennsylvania State College, who provided illustrations No. 55, 56, and 57 and made many valuable suggestions relating to the control of disease and insect enemies of the potato; to Dr. Frank D. Kern of The Pennsylvania State College for all botanical notes; to Prof. H. E. Hodgkiss of The Pennsylvania State College for all notes relating to injurious insects; and to Mr. Harvey Porch of Bridgeton, N. J., for the photograph from which was made the illustration on page 36. My son, Gilbert S. Watts, rendered valuable assistance in the preparation of the "Calendar."

R. L. WATTS.

SEPTEMBER 24, 1921.

VEGETABLE GROWING PROJECTS

CHAPTER ONE

VEGETABLE GROWING PROJECT CALENDAR OR SEASONAL PROGRAM

1. — Get Preliminary Experience

Work at every kind of vegetable growing operations that you find going on in your vicinity before classroom studying begins; and keep on working at such operations after school opens. Work for pay, if you can get it; or work for the chance it will give you to watch and learn, and take your pay in the greater skill and knowledge thus gained. Your own project should be built on sound experience.

2. — Adjust the Calendar to Your Project

The suggestions printed in the following calendar are based on the region around State College, Pennsylvania. In normal seasons they may be followed without change of months in localities where the first killing frost in the fall occurs about October first, and the latest killing frost in the spring about May tenth. Consult Weather Bureau Reports, seek local information, and adjust the calendar to your project by entering dates in the left-hand columns. Also, from time to time, insert in the open spaces provided for this purpose all other items needed to fit your program exactly to your peculiar conditions. Include, as they arise, the unexpected demands of your project, and the unanticipated opportunities for work and study. Keep your eye on it, perfect it, and in carrying it out be on time.

VEGETABLE GROWING PROJECTS

AUGUST

See page 1, section 2

Adjustments to Particular Localities <i>By the Pupil</i>	Project Work <i>By the Pupil</i>	Practicums and Laboratory Activities <i>By the Class</i>	Observations <i>By the Pupil</i>
Dates	Consider various possible projects. W: Full list. St: 63-64, 406 ff., 428-430, 454-457. GHG: Guide VI.	As a guide in determining projects; visit and study existing projects.	Be alert and watchful at all times.
	Find out what you could sell. GHG: Guides I and II.	Study transportation facilities in relation to your markets. C: 90-97.	
	Compare advantages of different plots of land. W-VG: 27. L: 9. GHG: Guide III.		
	Start compost for plant growing. W-VG: 151. GHG: Guide V.		

AUGUST

See page 1, section 2

Adjustments to Particular Localities	Project Work	Practicums and Laboratory Activities	Observations
<i>By the Pupil</i>	<i>By the Pupil</i>	<i>By the Class</i>	<i>By the Pupil</i>
Dates	Sow clover for green manure and cover crops. W-VG : 54-55. V : 99-104.	Put up compost heap to provide soil for plant growing, noting proportion of each material used. V : 163-164.	Keep an eye on projects of others to gain pointers for next season.
	Make last sowing for fall crop lettuce and spinach.		
	Plant Egyptian onion sets. W-VG : 383.		

VEGETABLE GROWING PROJECTS

SEPTEMBER

See page 1, section 2

Adjustments to Particular Localities <i>By the Pupil</i>	Project Work <i>By the Pupil</i>	Practicums and Laboratory Activities <i>By the Class</i>	Observations <i>By the Pupil</i>
Dates	Determine projects to be carried on. Hn: 162-171. GHG: Guide VI.	In a field trip study various locations with reference to suitability of soil and exposure for certain projects. C: 8-9. GHG: Guide IV.	Record date of first killing frost. GHG: Guide XXII.
	Select plots for projects. W: Full list. Sp: 47 GHG: Guide VI.	Visit fairs and other exhibits and study the best varieties.	Note the part moisture plays in starting green manure and cover crops.
	Prepare budget and accounting plan for projects. GHG: Guide VI.		

SEPTEMBER

See page 1, section 2

Adjustments to Particular Localities <i>By the Pupil</i>	Project Work <i>By the Pupil</i>	Practicums and Laboratory Activities <i>By the Class</i>	Observations <i>By the Pupil</i>
Dates	Select seed of sweet corn, tomato, pepper, eggplant, squash, cucumber. W-VG: 92-98. Wi: 194-195.	Visit markets and study carefully, noting such points as packages used for each crop, and method of placing vegetables in the packages. W-VG: 168-174. L: 285-286. GHG: Guide I.	Observe which green manure and cover crops start most certainly in droughty weather.
	Sow timothy or rye and vetch for cover crop. W-VG: 55-56.		
	Sow spinach to winter. W-VG: 426.		

VEGETABLE GROWING PROJECTS

OCTOBER

See page 1, section 2

Adjustments to Particular Localities <i>By the Pupil</i>	Project Work <i>By the Pupil</i>	Practicums and Laboratory Activities <i>By the Class</i>	Observations <i>By the Pupil</i>
Dates	Decide upon plant-growing equipment. W : 44-50. W-VG : 152-154. GHG: Guides VI and VIII.	Visit and study your market to determine the comparative advantages of (1) selling to wholesaler; (2) selling to retailers; (3) selling to consumers on curb market, and (4) selling from home to home. L: 294-302. GHG: Guide I.	Record date of first killing frost. GHG: Guide XXII. Watch the growth made by late celery and late cabbage this month.
	Store soil and rotten manure for starting early plants. W-VG : 151-152.		
	Collect one-peck sample of soil from garden to be planted. GHG: Guide III.		
	Sow rye and vetch cover crop. L: 29.		

OCTOBER

See page 1, section 2

Adjustments to Particular Localities	Project Work	Practicums and Laboratory Activities	Observations
<i>By the Pupil</i>	<i>By the Pupil</i>	<i>By the Class</i>	<i>By the Pupil</i>
Dates	Make sure there is rye straw for mats. W-VG : 154.	Draw up plans for a plank hotbed and a concrete hotbed, estimating the comparative costs. W-VG : 106. L : 63.	See what happens to the prices of "ten- der" vegetables after the first hard frost. GHG : Guide I.
	Select potatoes for planting next year. Fr : 52, 74, 175.		
	Save asparagus seed. H : 26-29. W-VG : 206-208.	Attend any school, community, or county vegetable exhibits within reach, making notes that will be of value in making your exhibit next fall.	Determine which green manure and cover crops are most effectively smothering out weeds.
	Dig hotbed pit. W-VG : 105. Tra : 51.		
	Make hotbed frame. W-VG : 106. L : 63.		

VEGETABLE GROWING PROJECTS

NOVEMBER

See page 1, section 2

Adjustments to Particular Localities <i>By the Pupil</i>	Project Work <i>By the Pupil</i>	Practicums and Laboratory Activities <i>By the Class</i>	Observations <i>By the Pupil</i>
	Grade level area for cold frames. W-VG: 114-115.	Visit large commercial gardens and note in detail the storing of crops. W-VG: 193-195. C: 82-89. L: 304-311. GHG: Guide XI.	Record date when ground freezes for the winter. GHG: Guide XXII.
	Make cold frames. W-VG: 115-117. L: 66. C: 55-57. GHG: Guide VIII.		
	Protect soil in hot-beds and cold frames from deep freezing.		
	Dig and store rhubarb roots for forcing. W-VF: 199.		
	Plow garden. W-VG: 29-30. V: 71.		

NOVEMBER

See page 1, section 2

Adjustments to Particular Localities	Project Work	Practicums and Laboratory Activities	Observations
<i>By the Pupil</i>	<i>By the Pupil</i>	<i>By the Class</i>	<i>By the Pupil</i>
Dates	Sow rye as cover crop. W-VG : 53.	Estimate costs and returns for various crops. Hn : 117-134, 148- 161. GHG : Guide II.	Note the compara- tive amounts of top growth made by different green ma- nure and cover crops.
	Make straw mats. W : 50. W-VG : 154. GHG : Guide VIII.		
	Make flats. W : 48. W-VG : 152. GHG : Guide VIII.	Make straw mats. W : 50. W-VG : 154.	Record date of first snow that remains.
	Make map of your project plot. GHG : Guides IV and VI.		
	Apply manure to project plot. W-VG : 49-50.		

DECEMBER

See page 1, section 2

Adjustments to Particular Localities	Project Work	Practicums and Laboratory Activities	Observations
<i>By the Pupil</i>	<i>By the Pupil</i>	<i>By the Class</i>	<i>By the Pupil</i>
Dates	Complete details of projects. GHG: Guide VI.	Test sample of soil from plot for acidity. Study physical properties Sp : 119. V : 247-248. GHG: Guide V.	Record date of the season's first snow to remain.
	Make transplanting boards, dibbers, and paper pots. W-VG: 160. GHG: Guide VIII.	On a blank map locate important markets within convenient trucking or shipping distance. Note on the margins the population of each. GHG: Guide VI.	
	Repair and paint tools and implements. W-VG: 40. GHG: Guide VIII.		

DECEMBER

See page 1, section 2

<u>Adjustments to Particular Localities</u>	<u>Project Work</u>	<u>Practicums and Laboratory Activities</u>	<u>Observations</u>
<u>By the Pupil</u>	<u>By the Pupil</u>	<u>By the Class</u>	<u>By the Pupil</u>
Dates	Repair and paint old sash. W-VG : 108. GHG : Guide VIII.	Repair and paint hotbed sash, noting such details of construction as type of mortise or central bracing. W-VG : 107-109. GHG : Guide VIII.	Compare green manures in their ability to hold snow.
	Glaze and paint new sash. W-VG : 108.	Study labor, capital, accounting, and administrating as applied to market gardening. GHG : Guides VII, X, and XII.	
	Make an inventory of old tools and equipment and determine new equipment required. H : 109-116.		

VEGETABLE GROWING PROJECTS

JANUARY

See page 1, section 2

Adjustments to Particular Localities <i>By the Pupil</i>	Project Work <i>By the Pupil</i>	Practicums and Laboratory Activities <i>By the Class</i>	Observations <i>By the Pupil</i>
Dates	Work on home gar- den plans. W : 293. L : 265-276. C : 105-110.	Study the seeds of various vegetables, noting size, shape, color, markings, if any, and character of seed coats. Sp : 170-172. GHG : Guide IX.	Note the compara- tive freedom of var- ious samples of seed from weed seeds and dirt. GHG : Guide IX.
	Order seeds. W-VG : 99. GHG : Guides VI and IX.		
	Order fertilizer. W-VG : 68. V : 233-241. GHG : Guide VI.	Determine number of seeds to the ounce of important vegetables. W-VG : 496-497. GHG : Guide IX.	Note new rootlets on celery removed from storage.
	Order lime. V : 249. GHG : Guide VI.		
	Order insecticides. CL : 368-381. GHG : Guide VI.		
	Order new tools. W-VG : 28-40.	Practice identifica- tion of unnamed or mixed samples of vegetable seeds. GHG : Guide IX.	

JANUARY

See page 1, section 2

Adjustments to Particular Localities	Project Work By the Pupil	Practicums and Laboratory Activities By the Class	Observations By the Pupil
Dates	As seeds arrive, mark each package with the month and year.	Disinfect such vegetable seeds as require this treatment, making detailed records of materials used, duration of treatment, washing and subsequent care of the seeds. SH : 7.	Record depth of snow and of frost penetration into the soil.
	Make germination tests. W-VG : 101. GHG : Guides VI and IX.		
	Force rhubarb. W-VF : 190-197. M : 5-27.	Take two samples from the same lot of seed and test for germination and vitality, using the blotting paper and dish method in one case, and sowing the seeds in a flat of soil in the other case. Study results. W-VG : 101. Sp : 298. GHG : Guide IX.	Visit markets, noting which crops are shipped in from the South, and which are being supplied from storage in the North. GHG : Guide I.
	Design trade marks. W-VG : 176-177.		
	Market stored crops. W-VG : 167-168.		

FEBRUARY

See page 1, section 2

Adjustments to Particular Localities	Project Work		Practicums and Laboratory Activities	Observations
	<i>By the Pupil</i>	<i>By the Class</i>		
Dates	Make hotbed. W : 44. W-VG : 110. L : 60-62. Sow early cabbage, early lettuce, kohlrabi, and Prizetaker onions. W : under each crop. W-VG : 133, 134, 154. GHG : Guides VI and IX.	Study statistics on the average prices of cabbage or root crops in October, November, January, and February. The Market Reporter, U. S. Dept. of Ag. GHG : Guide I.		Note changes taking place in fall plowed land left lumpy. W-VG : 29.
	Give hotbed daily attention. W-VG : 155.	Study seedlings of various vegetables, noting distinguishing characteristics.		Examine root crops in pits, noting change in condition since last examined.

FEBRUARY

See page 1, section 2

Adjustments to Particular Localities <i>By the Pupil</i>	Project Work <i>By the Pupil</i>	Practicums and Laboratory Activities <i>By the Class</i>	Observations <i>By the Pupil</i>
Dates	Make detailed garden plans. Force rhubarb. W-VF: 190-197.	Study minutely pea, bean, and corn seedlings, making detailed drawings of each. R : 59, 178, 417, 422.	Compare prices received for crops from storage with prices offered for the same crops when put in storage. GHG : Guide I.
	Market forced rhubarb. W-VF: 201-203.	Mix soils for plant growing, noting how to moisten without puddling; and noting the influences of varying proportions of sand, fine rotten manure, and loam on the resulting mixture. W : 52. GHG : Guide XIV.	Visit markets. Note when the frost comes out of the ground.
	Market stored crops. W-VG : 281.		Observe temperature changes in hotbed.

MARCH

See page 1, section 2

Adjustments to Particular Localities	Project Work	Practicums and Laboratory Activities	Observations
	By the Pupil	By the Class	By the Pupil
Dates	Sow tomatoes, early celery, cauliflower, and beets for transplanting. W : under each crop. GHG : Guide VI.	Work out fertilizer mixing problems. W-VG : 69-71. V : 254.	Note when the frost comes out of the ground.
	Transplant seedlings started in February. W : under each crop. GHG : Guide IX.	Disinfect all seed potatoes, making notes on important points. W : 216. Fr : 180. SH : 240.	Note the color, odor, and taste of common fertilizing materials. GHG : Guide V.
	Mix fertilizers. V : 215-218. GHG : Guides V and VI.		
	Clip tops of onion seedlings. W : 234.	Transplant seedlings, studying to develop the greatest possible speed through use of a definite system of dropping and setting plants and the elimination of unnecessary movements.	Observe "heaving" of wintered spinach, parsnips, or wheat.
	Order packages for marketing. C : 92.	W-VG : 155-157. GHG : Guide IX.	Draw conclusions in regard to the kinds of winters, locations, and soils conducive to serious heaving.
	Market stored crops.		

MARCH

See page 1, section 2

Adjustments to Particular Localities <i>By the Pupil</i>	Project Work <i>By the Pupil</i>	Practicums and Laboratory Activities <i>By the Class</i>	Observations <i>By the Pupil</i>
Dates	Sow peppers and egg- plants. W : 77, 83.	Compare several seedlings of the same kind and age, but grown under different condi- tions of moisture, temperature, or light, noting firm- ness of tissue, color, and general vigor.	Note which green manure and cover crops make the greatest early spring growth.
	Give hotbeds and cold frames fre- quent attention.		
	Start to harden early cabbage. W : 98.		
	Manure project plot. C : 49-50.	Mix fertilizers, keep- ing an accurate record of time. Compute the saving or increase in cost per ton over buying mixed goods. GHG : Guide V.	From the flats of several students note the effects of too deep and too shallow covering of seed.
	Plow, if land is fit. W-VG : 30. V : 72. GHG : Guides VI and XI.		
	Market forced rhu- barb. M : 29-32. W-VF : 201-203. GHG : Guide XI.		
	Sow spinach, lettuce, radishes, and peas, if possible. W : under each crop. GHG : Guides VI and XI.		Observe temperature changes in cold frame.

APRIL

See page 1, section 2

Adjustments to Particular Localities <hr/> <i>By the Pupil</i>	Project Work <hr/> <i>By the Pupil</i>	Practicums and Laboratory Activities <hr/> <i>By the Class</i>	Observations <hr/> <i>By the Pupil</i>
Dates	Transplant into cold-frame seedlings started in March.	Prepare a plot for planting, using various tools and noting their relative efficiency in breaking clods, leveling, mixing in fertilizer or lime, and in firming the soil.	Note how much more easily clods may be broken when harrowing soon after plowing rather than after the wind has dried the lumps.
	W-VG : 155-157. GHG : Guide VI.	GHG : Guide XI.	
	Plow project plot. W-VG : 30. V : 72. GHG : Guide VI.		
	Prepare plot for planting. W-VG : 31-34. GHG : Guide VI.		
	Plant peas, early potatoes, lettuce, beets, carrots, early turnips, parsnips, onion seeds, and onion sets. W : under each crop. GHG : Guides VI and XI.	Study garden seed drills to learn the names, uses, and adjustments of each part.	Watch how plants in the frames "shoot up" when their leaves begin to touch each other.
	Catalogues and instruction sheets. GHG : Guide VIII.		
	Transplant cabbage, lettuce, and kohlrabi into field. W : under each crop. GHG : Guides VI and XI.		
	Sow asparagus seed in field. H : 30-34. W : 271.		Look for difference in frost injury to well-grown, well-hardened cabbage plants as compared with weak, tender plants.
	W : 272. H : 49-60.		

APRIL

See page 1, section 2

<u>Adjustments to Particular Localities</u>	<u>Project Work</u>	<u>Practicums and Laboratory Activities</u>	<u>Observations</u>
<u>By the Pupil</u>	<u>By the Pupil</u>	<u>By the Class</u>	<u>By the Pupil</u>
Dates	Plant rhubarb. W : 280. L : 403.	Set out asparagus and rhubarb roots, studying each. Determine why asparagus is propagated from seeds and rhubarb by division of old crowns.	Keep notes on growing conditions. Record belated snows, freezes, long rainy periods, or unusually warm weather.
	Sow oats and peas for green manure. W-VG : 56.	W-VG : 208, 209, 419, 420.	
	Avoid too high temperatures in the frames.		
	Start cucurbits in pots under glass. W : 156. V-VG : 332.	Make a study of and record briefly factors you find important in avoiding loss of plants when setting in the field.	Note the dates on which home-grown vegetables of various kinds first appear in the market.
	Start cultivation as soon as rows can be seen. W-VG : 34-37.		GHG: Guides I and XVIII.
	Transplant a second time crowded tomatoes, eggplants, or peppers. W : 59.		
	Harvest rhubarb, wintered spinach, and Egyptian onions.		
	Combat garden pests. W, SH, and CL.		Note uneven growth of plants when flats are not filled uniformly.

MAY

See page 1, section 2

Adjustments to Particular Localities <i>By the Pupil</i>	Project Work <i>By the Pupil</i>	Practicums and Laboratory Activities <i>By the Class</i>	Observations <i>By the Pupil</i>
Dates	Sow late celery. W : 128. B : 43-46.	Dig up one square foot of a green ma- nure crop, taking with it the soil one foot deep, wash the soil away, and determine the ton- nage of organic matter per acre.	Note nodules on le- guminous cover crops. Sp : 148-151.
	Sow late cabbage and late cauliflower. R : 20-21.		
	Sow lettuce for suc- cession.		
	Top dress backward crops with ferti- lizer.	Note the habit and bulk of growth of roots and tops of various green ma- nure and cover crops. Draw con- clusions as to value of each in "soil binding," weed ex- terminating, ability to winter, and dan- ger of becoming a weed or interfering with cultivation.	Compare root devel- opment as green manures and cover crops are plowed under.
	W-VG : 60-61.		Rb : 10-14.
	Plant sweet corn. W : 288.		
	GHG : Guide VI.		
	Plant all cucurbits. W : 151.		Note the dates of killing frosts.
	Plant beans. W : 253.		
	Provide support for peas.		
	W : 264. W-VG : 412.		
	S-P : 74.		
	Market asparagus, rhubarb, and other crops.		Keep up with notes on growing condi- tions.
			GHG : Guides XIII and XV.

MAY

See page 1, section 2

Adjustments to Particular Localities <i>By the Pupil</i>	Project Work <i>By the Pupil</i>	Practicums and Laboratory Activities <i>By the Class</i>	Observations <i>By the Pupil</i>
Dates	Transplant into field early celery and Prize-taker onions. W : 130, 239.	Top dress a growing crop with nitrate of soda or ammonium sulphate, making careful calculations as to area to be covered and the amount of fertilizer required to equal 150 pounds of nitrate of soda per acre. GHG : Guide VI.	Note the dates on which various kinds of home-grown vegetables first appear in the market.
	Cultivate frequently. V : 69-71. GHG : Guide VI.		
	Thin to correct stand. W-VG : 133.		
	Watch for and control insect and fungous enemies. W, SH, and CL. GHG : Guides VI and XI.	Practice planting. Have contests for skill and speed. GHG : Guide V.	Note the rebranching of roots when setting transplanted plants in the field.
	Mark high-yielding asparagus crowns. Plow down green manures.		
	Harrow at once and repeat at intervals, if land is fallow.	Practice cultivating, weeding, and thinning closely planted crops, drawing conclusions as to the comparative efficiency of different wheel hoes, weeder, and your own fingers for the various phases of this work.	Compare frost injury to tender crops in low locations with that to the same crops on higher land. GHG : Guide XXII.
	Transplant tomatoes into field. W-VG : 141, 460. L : 49.		Begin field study of botany of vegetables. GHG : Guide XXI.
	Transplant to field cucurbits started in pots. W-VG : 334-335.	GHG : Guide XI.	Note beneficial birds about the garden.

JUNE

See page 1, section 2

Adjustments to Particular Localities	Project Work By the Pupil	Practicums and Laboratory Activities By the Class	Observations By the Pupil
Dates	Transplant eggplants and peppers into field. W : 82, 86. GHG : Guide VI.	Make a study of available spraying equipment, learn- ing the care and adjustment of all parts. GHG : Guide VIII.	Note the dates of killing frost. GHG : Guide XXII.
	Plant late sweet corn. W : 288. GHG : Guide VI.		Do not neglect notes on growing condi- tions. Record such things as drought, hail, or serious damage from pests.
	Plant late potatoes. Fr : 91-104.		GHG : Guide XII.
	Plant bush beans for succession. GHG : Guide VI.	Study the character- istics of important spray materials and prepare them for use in the field.	CL : 368-381.
	Stake, prune, and tie tomato vines. W-VG : 461-463. Tra : 79-89.	GHG : Guide XI.	Note the date on which home-grown vegetables of var- ious kinds first appear in the market.
	Top dress with ferti- lizer if necessary. W-VG : 60-61.	Use both large-tooth and fine-tooth horse-drawn culti- vators, comparing their efficiency as weed killers and mulch producers,	GHG : Guide XVIII.
	Cultivate crops. V : 73.	the depth and ra- pidity of operation, and noting adapta- bility to special crops.	Compare the devel- opment of "bot- toms" on root crops where amply spaced and where crowded.
	Hoe and weed crops. W-VG : 37-40.	GHG : Guide VIII.	
	Thin to correct stand. C : 37. GHG : Guide XI.		

JUNE

See page 1, section 2

Adjustments to Particular Localities	Project Work	Practicums and Laboratory Activities	Observations
<i>By the Pupil</i>	<i>By the Pupil</i>	<i>By the Class</i>	<i>By the Pupil</i>
Dates	Sow late root crops, French endive, and Brussels sprouts. W-VG : 247, 291, 466. W-VF : 375.	Make a study of insects affecting potatoes, cabbages, tomatoes, and peas at this season. Determine how each feeds and note the character of its coat.	Note the relation of seed testing and accurate adjustment of the drill to subsequent labor of thinning.
	Transplant into field late cabbage and late cauliflower. W-VG : 272, 300. R : 46-59.	CL: under each crop. GHG : Guides XI and XVI.	Keep a close eye on way different companion cropping schemes work out. GHG : Guide IV.
	Harvest and market lettuce, radishes, spinach, green onions, rhubarb, and asparagus. W: under each crop. GHG : Guides VI and XI.		
	Combat garden pests. W, SH, and CL.		
	Transplant late celery into field. W-VG : 312. C : 198. B : 54.		Watch the movement of prices in your market as the season progresses. GHG : Guide I.
	Cradle rye for mats.		
	Remove suckers from sweet corn. Wi : 25, 72, 182.		
	Discontinue cutting asparagus. W-VG : 220.		
	Be on the alert to prevent insect and disease injuries. GHG : Guides XVI and XVII.		Note the effect of different plant foods on garden crops. GHG : Guide XIII.

JULY

See page 1, section 2

Adjustments to Particular Localities <i>By the Pupil</i>	Project Work <i>By the Pupil</i>	Practicums and Laboratory Activities <i>By the Class</i>	Observations <i>By the Pupil</i>
Dates	Plant early varieties of sweet corn for fall crop.	Determine the names, habits of growth, kinds of root sys- tem, and means of reproduction of common garden weeds. GHG : Guide XXV.	Make notes on grow- ing conditions.
	Plant late cucumbers. W : 160.		
	Cultivate frequently.	Find out the length of time required by chickweed for the production of seed.	Note the dates on which home-grown vegetables of var- ious kinds first appear in the mar- ket.
	Hoe crops. W-VG : 37-38.		
	Combat garden pests. W, SH, and CL.		
	Harvest and market crops promptly.		Visit the markets, noting vegetables in liberal supply and in short sup- ply, and their prices.

JULY

See page 1, section 2

Adjustments to Particular Localities <hr/> <i>By the Pupil</i>	Project Work <hr/> <i>By the Pupil</i>	Practicums and Laboratory Activities <hr/> <i>By the Class</i>	Observations <hr/> <i>By the Pupil</i>
Dates	Plant bush stringless beans for fall.	Make a study of the vegetable package situation in all its phases as it exists in your local market.	Visit one or more farms specializing in vegetables, noting system of cropping, rotation, if any, planting distances, and other important features.
	Prune and tie staked tomatoes. W-VF : 280-284. L : 246-248.	Study in the field diseases affecting vegetables. Take steps to establish the identity of each and familiarize yourself with measures of control. SH : Full list. GHG : Guide XI.	Note inefficiency of dull hoes.
			Continue study of botany of vegetables.
			GHG : Guide XXI.

AUGUST

See page 1, section 2

Adjustments to Particular Localities	Project Work — <i>By the Pupil</i>	Practicums and Laboratory Activities — <i>By the Class</i>	Observations — <i>By the Pupil</i>
Dates	Combat garden pests. W, CL, and SH.	Plan for school and other vegetable exhibits. GHG: Guide II.	Keep up notes on growing conditions. GHG: Guides XV and XIX.
	Plant late turnips. W : 187.		
	Sow last lettuce and spinach for fall crop.	Study asparagus and rhubarb to deter- mine the functions and relative im- portance of leaves and stems in each. Rb : 244, 286.	Record dates on which various early crops leave the land vacant for succession crops or green manures. GHG: Guide IV.
	Sow winter radishes. W-VG : 418.		
	Cultivate crops.	Determine which of the insects present at this season affect more than one crop.	
	Keep weeds out of the rows.	CL: Full list. GHG: Guide XI.	

AUGUST

See page 1, section 2

Adjustments to Particular Localities	Project Work		Practicums and Laboratory Activities	Observations
	By the Pupil	By the Class		
Dates	Market crops. Sp : 329-330.	Spray a crop in the field, keeping accurate record of time and materials used per acre. GHG : Guide XI.	In gardens throughout your neighborhood note the comparative ability of various vegetables to succeed in shaded locations.	
	Save tomato and pepper seed. Tra : 112-116.			
	Blanch early celery with boards or paper. W-VG : 316-318. B : 95-98.	Estimate the cost per acre per application and state how this may be influenced by equipment.	Continue study of botany of vegetables. GHG : Guide XXI.	
	Harvest early onions. W : 244. L : 168.			
	Sow lettuce for fall crop in frames. W-VF : 404.			

SEPTEMBER

See page 1, section 2

Adjustments to Particular Localities By the Pupil	Project Work By the Pupil	Practicums and Laboratory Activities By the Class	Observations By the Pupil
Dates	Combat garden pests. W, CL, and SH.	Complete plans for school and other vegetable exhibits.	Make notes on grow- ing conditions.
	Cultivate crops.	Go into your plot and study in detail five individual plants of the same variety, noting and record- ing differences in size of plant or fruit, shape or color of leaf, or habit of growth.	Recognize plants as <i>individuals</i> . Plants from seed are as distinctly individ- ual as animals. Learn to see the difference between brother plants. This is essential in selection for seed growing.
	Market crops. Har- vest closely to avoid losses in the field.		GHG: Guide XXIII.
	Save sweet corn, to- mato, pepper, egg- plant, cucumber, and squash seeds. W-VG : 92-99.		

SEPTEMBER

See page 1, section 2

Adjustments to Particular Localities <i>By the Pupil</i>	Project Work <i>By the Pupil</i>	Practicums and Laboratory Activities <i>By the Class</i>	Observations <i>By the Pupil</i>
Dates	Break leaves over cauliflower heads. W:116. W-VG:300.	Study the tomato, squash, and aspar- agus, determining the method of pol- lination in each case. Rb : 247-249, 588, 611.	Visit one or more farms specializing in vegetable grow- ing. Note care- fully implements, tools, buildings, and wagons or trucks for market- ing. GHG : Guide XVIII.
	Harvest squashes, sweet potatoes, onions, tomatoes, eggplant, and pep- pers. W: under each crop.	Practice selection of vegetables for ex- hibition.	Continue study of botany of vege- tables. GHG : Guide XXI.
	Sow cover crops.		
	W-VG : 53-57.		

OCTOBER

See page 1, section 2

Adjustments to Particular Localities	Project Work	Practicums and Laboratory Activities	Observations
	<i>By the Pupil</i>	<i>By the Class</i>	<i>By the Pupil</i>
Dates	Combat garden pests. W, CL, and SH. Ridge celery. W-VG : 315-319. B : 99.	Practice judging of plate displays and market packages of vegetables. GHG : Guide II.	Mark and weigh several squashes when placed in storage.
	Select potato tubers for winter exhibits.		
	Select seed potatoes. Fr : 175-176.	Practice judging veg- etables in contests at school. GHG : Guide II.	Visit vegetable ex- tension demonstra- tions.
	Save asparagus seed. H : 28-29.		
	Market crops.		
	Sow cover crops. W-VG : 53-57.	Compete in vegetable judging contests with teams repre- senting other schools.	
	Complete ridging of celery.		

OCTOBER

See page 1, section 2

Adjustments to Particular Localities	Project Work	Practicums and Laboratory Activities	Observations
<i>By the Pupil</i>	<i>By the Pupil</i>	<i>By the Class</i>	<i>By the Pupil</i>
Dates	Gather refuse and burn it.	Set up school vege- table exhibit. GHG : Guide II.	Observe wide varia- tions in quality of produce on the markets at this sea- son.
	Select root crops for winter exhibits.		
	Make sauerkraut. W-VG : 289-290.		Close up all summer field studies (bot- any, insect, dis- ease, etc.).
	Take your inventory and close your project accounts, if your work is done, or if your report is now due. GHG : VI.		GHG : Guides XVI, XVII, and XXI.
	Prepare brief digest or report, in writ- ing, of your vege- table growing experience and conclusions as bearing on your future projects in this field.		

NOVEMBER

See page 1, section 2

Adjustments to Particular Localities	Project Work		Practicums and Laboratory Activities	Observations
	By the Pupil	By the Class	By the Class	
Dates	Store celery and leeks. W-VG : 321-325, 351. B : 104-111.	Protect lettuce in the field with coarse straw.	Store celery and leeks in trenches, recording details of the operation. W-VG : 322-323.	Observe changes in weight of stored squashes.
	Dig and store young asparagus roots W-VF : 182-183.	Market crops.	Bury late roots in pits, showing by sketches the position of the roots in completed pits. L : 308-309.	Visit vegetable forcing houses, noting variation in practice from that followed in the open.
	Store cabbage. W-VG : 275-281. R : 77, 96-104.	Store root crops. C : 82-88. L : 308-309.		
	Dig and store rhubarb roots for forcing. W-VF : 199.	Protect the hotbed and cold frame water system from frost.		

NOVEMBER

See page 1, section 2

Adjustments to Particular Localities <i>By the Pupil</i>	Project Work <i>By the Pupil</i>	Practicums and Laboratory Activities <i>By the Class</i>	Observations <i>By the Pupil</i>
Dates	Protect soil in hot-beds and frames from freezing.	Study market reports clipped throughout the season. Plot price curves.	Note rootlets and root hairs being formed on celery in trenches. Rb : 18-20.
	Mulch these crops: asparagus, rhubarb, Egyptian onions, spinach to winter.	Study varieties and strains of late cabbage. W : 91.	Compare decay among squashes with broken stems and with stems intact.
	Give buried crops additional protection as the weather grows severe.		
	Clean implements and tools, oil metal parts, and store. W-VG : 40.	Study varieties of squash. W : 174.	

DECEMBER

See page 1, section 2

<u>Adjustments to Particular Localities</u>	<u>Project Work</u> <u>By the Pupil</u>	<u>Practicums and Laboratory Activities</u> <u>By the Class</u>	<u>Observations</u> <u>By the Pupil</u>
Dates			
	Watch the temperature and moisture conditions when storing crops in cellars.	Visit and study construction and operation of large commercial storage houses and root cellars.	Compare November and October losses in weight of stored squashes.
	Make sure that crops buried in pits or trenches have adequate protection.	Study varieties of onions. W : 232.	Note spread of rot from one specimen to another where squashes touch each other.
	Market crops from storage.		
	Repair tools and order new parts. W-VG : 40.	Study varieties of root crops. W : under each crop.	Note decay and general condition of root crops in pits.

DECEMBER

See page 1, section 2

Adjustments to Particular Localities <i>By the Pupil</i>	Project Work <i>By the Pupil</i>	Practicums and Laboratory Activities <i>By the Class</i>	Observations <i>By the Pupil</i>
Dates			
	Repair and paint hot-bed sash. W-VG : 108.	Study your project records and draw up a program for a similar project another season, making the new plan reflect clearly points that have an important bearing on the success of the project and that have been made clear through your experience and observations.	Note changes taking place in the hearts of stored celery.
	Overhaul and make replacements in plant-growing equipment. W-VG : 152-153, 160-161.		Note any celery diseases that continue activity in the stored crop.
			Rb : 175-176.
			Summarize your experience and conclusions in a final report.
	Work your final project records into compact, available form for reference and judgment.		

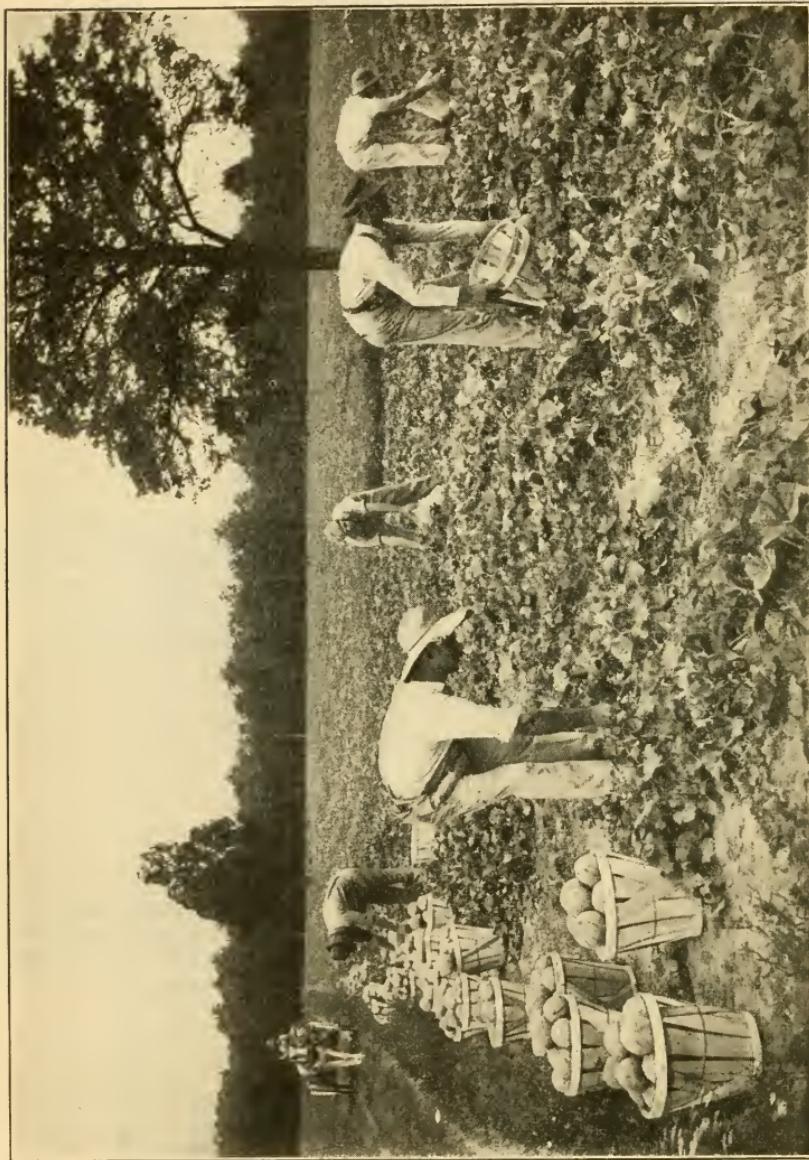


FIG. 1.—A successful crop of New Jersey cantaloupes.

CHAPTER TWO

SOLANACEOUS CROP PROJECTS

Tomato, Eggplant, Pepper

The solanaceous plant family includes the tomato, potato, eggplant, pepper, Jimson weed, ground cherry, nightshade, tobacco, and petunia. Most of the members of this family are natives of tropical regions, which accounts for the fact that they are "tender" and liable to injury from frosts when grown in temperate regions.

Project I. Growing Tomatoes

The tomato belongs to the family Solanaceae. It is usually referred to as the Nightshade family. In this family the foliage is strong-scented and in many species the fruit is poisonous or narcotic. The tomato was early known as "Love Apple" and was long regarded with suspicion, doubtless on account of its undesirable relatives, such as the nightshades. It is a native of South America, where it is still to be found in the wild condition. It has a fibrous root system. When the young plants are transplanted some of the fine rootlets wilt or are destroyed and new roots with greater vigor are developed. In this way transplanting may increase the vigor of the plants.

The leaves are compound and stalked and arranged alternately on the stem. Since the leaves are the food-making organs of the plant, anything that interferes with their development will affect the yield of fruit. If the leaves are not a healthy green color, do not grow to full size, are injured by insects, or are

spotted by the growth of fungi, the crop of fruit is sure to be affected.

The fruit is a true berry, a fleshy fruit with the seeds embedded in a pulpy mass as in a grape or currant. The seeds are numerous and small. There are many varieties of the tomato, differing especially in the arrangement, size, shape, and color of the fruit. These numerous varieties that have been produced by breeding in cultivation can be reduced to five botanical types or groups, although it has been estimated that seedsmen offer as many as 175 so-called varieties.

In order that the fruit may set well, the flowers must be well pollinated. Out of doors no assistance is necessary, but in greenhouses jarring the plants or other means of artificially transferring the pollen is required. The flowers are usually self-pollinated and there is not much tendency for varieties to cross even if grown close together. The flowers are perfect; the corolla is wheel-shaped and five- or six-parted.

1. What are some of the near relatives of the tomato?
2. How can you explain the fact that the tomato is "tender"?
3. How does transplanting tend to increase the vigor of young plants?
4. Can you tell by the leaves whether a plant is healthy and vigorous?
5. What kind of fruit is the tomato?
6. How many botanical types of tomatoes are there? How many varieties?
7. What is pollination? What kind occurs in the tomato flowers?

Project Outline

1. Why grow tomatoes?
2. Selecting location.
3. Choosing varieties
4. Obtaining seed.
5. Constructing the hotbed.
6. Constructing the cold frame.
7. Making plant boxes.
8. Making straw mats.
9. Sowing seed.
10. Caring for the seedlings.
11. Making paper pots.
12. Transplanting.
13. Hardening the plants.
14. Preparing the garden soil.
15. Planting in the garden.
16. Planting with other vegetables.
17. Cultivating.
18. Training the plants.
19. Combating insects and diseases.
20. Harvesting and marketing.

1. Why grow tomatoes? — The tomato is one of our most important garden crops. Thousands of acres of tomatoes are grown annually to supply the enormous demand of the markets and of the canning factories. The fruit is so popular among American consumers that it is rarely omitted in the crops of the home garden.

1. Is there a considerable demand for tomatoes on your local market?
2. Can you ship tomatoes and realize a profit?

3. Is the tomato a profitable crop in your community?
4. How important is the tomato as a home garden crop? L: 244.
5. What is the general commercial importance of the tomato crop?
L: 244. Tra: 18.
6. What is known about the history of the tomato?
7. What are its main botanical characteristics?
8. How does it compare with other vegetables in food value? What is its chemical composition?

2. **Selecting location.** — The tomato may be grown successfully in any fertile garden soil, provided it is well drained. Soils containing considerable sand are especially valuable in growing the early crop, but most excellent yields are obtained from even the very heavy types of soil. The lighter soils, however, are easier to work, and, if available, should be chosen in preference to heavy clay loams.

If tomatoes are grown on the same land year after year, destructive diseases will soon appear. It is important, therefore, to grow tomatoes in rotation with other vegetables, or preferably in rotation with general farm crops.

It is important to bear in mind that the tomato is a "tender" vegetable, and that the plants grow and fruit better on southern exposures affording protection from hard winds, than on cold northern or western slopes.

1. What soil is best for tomatoes?
W-VG: 452. Tra: 33-37.
2. Have you a suitable soil for growing tomatoes? Describe it.

3. Should tomatoes be grown in the same soil year after year?
W-VG : 473. L: 83. C: 4.
4. Does the soil which you have selected need drainage? How do you know?
5. What is the best exposure of the land for growing tomatoes?
6. *What are the advantages of sandy soils?* W-VG : 25.
7. *What are the disadvantages of heavy, clay soils?*

3. Choosing varieties. — Great progress has been made in the development of varieties. There are now so many good varieties that it is often difficult to decide which are best for a particular purpose.

Varieties differ in vigor and habit of growth (Tra: 97-111). For example, the plants of the Stone, an old well-known sort, are vigorous and spreading, those of the Earliana are not so vigorous, and the plants of a variety like Dwarf Stone are vigorous and upright in habit of growth.

Some varieties, as the Earliana, mature early, while others, as the Stone, mature late. Again, varieties differ in the color of the fruit. Red kinds predominate; there are many pink and purple-fruited varieties and a few yellow ones.

Among the early varieties, Earliana is the best known and the most largely grown. The plants are productive, fruits are red in

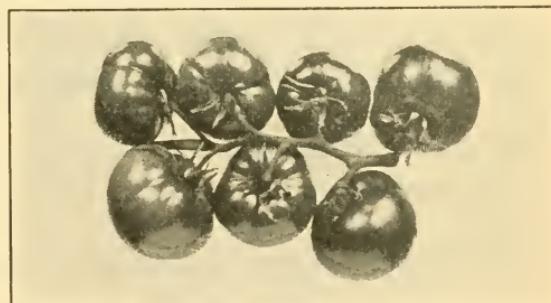


FIG. 2.—Bonny Best tomato, an excellent type for commercial gardening, largely grown under glass.

color, and they ripen as early as any other variety. Bonny Best is a better variety in some respects than Earliana, but it begins to ripen several days later. The fruits are red, solid, and of good size. Chalk's Jewel is somewhat similar to Bonny Best. It is a red tomato of large size. June Pink is a popular early pink sort, and Globe is a pink, medium early tomato that has made many friends.

Of the large red varieties, Stone and Matchless are the most popular. Beauty and Trucker's Favorite are excellent pink sorts.

Earliana, Bonny Best, and Matchless, planted early and at the same time, should give a succession of fruit from early in July until frost kills the plants in the fall.

There are many other varieties of merit, but we should select those which produce large crops of smooth, solid tomatoes, and which are liked by the family or by the market to be supplied.

1. What varieties are preferred by your local market?
2. What varieties are liked best by your family?
3. What varieties should be selected for a succession of fruits?
4. Select varieties that you will plant. Give reasons for their selection.
5. Name the leading early varieties.
W-VG : 454. C : 442.
6. Name the leading late varieties.
W-VG : 455. C : 442.
7. Classify by color the varieties that you know.
8. What varieties are grown most largely for canning?

4. Obtaining seed. — The greatest care should be exercised in procuring seed. Inferior seed is often the cause of a poor crop. Saving home-grown seed is common. It is an exceedingly interesting proposition and might be tried in a limited way even by beginners. Selections should be made from healthy plants, bearing a heavy crop of large, well-shaped tomatoes. The cluster of fruit shown in Fig. 2 is of the type from which seed should be selected. The actual saving and curing of tomato seed is a simple matter. Only ripe specimens should be chosen. They are cut or broken and placed in any convenient vessel. Fermentation will soon loosen the mucilaginous covering of the seeds. It is well to stir the mass of pulp and seeds several times until the covering of the seeds is loose, then the seeds are readily separated from the pulp by washing. The pulp and light seeds rise to the top of the water and are poured off. A few changes of water will result in clean seed, which should then be spread on a cloth to dry before being stored. Any living room will furnish suitable conditions for storing tomato seed. If the seed is not saved at home, it should be purchased from reputable dealers, and the order should be placed as early in the year as possible. An ounce of tomato seed should produce at least 4,000 plants.

1. Where can you buy good seed of the varieties selected?
2. How much seed will you need for your tomato project?
3. Is it desirable to buy a surplus for next year? If so, why?
4. How and where should tomato seed be stored?
5. Does it pay to save seed at home? When and why?

W-VG : 456. W-VG : 92. W-VG : 96. L : 16.

6. *How should tomato seed be selected, cleaned, and stored?*

W-VG: 97-99. L: 17. Tra: 112.

7. *How many years will tomato seed retain its vitality?*

5. **Constructing the hotbed.**—In northern sections, tomatoes are always started where there is at least some artificial heat. In thousands of homes a sunny window serves the purpose, but a well-constructed hotbed has special advantages. Whether the tomatoes are wanted for market or for the home table, earliness is an exceedingly important factor.

The hotbed should be located near the residence, if possible, for it may require attention several times a day. It should also be near an abundant supply of water. Any protection afforded by buildings, trees, fences, or hills on the north or northwest will be a great advantage. Southern and southeastern exposures are preferred. Good soil drainage is also essential.

The hotbed pit should be dug in the fall before the ground is frozen to any considerable depth. It should be dug so that the sash will slope to the south or southeast. The depth of the pit will depend largely on the severity of the climate and the time the seed is to be sown. Two feet of manure, or a pit about two feet deep, is entirely satisfactory, for most sections of the North.

The frame may be built of wood, concrete, brick, or stone. Home gardeners generally line the pit with plank or boards and construct a wooden frame for the top. The upper or north side of the frame should be about 6 inches higher than the lower or south side. If the hotbed is to be used year after year, a concrete frame will be found more economical.

The standard hotbed sash is 3×6 feet in size, and the smaller hotbeds are generally made to accommodate either two or four sashes, thus being 6×6 feet or 6×12 feet in size. It is a simple matter to paint and glaze the sash at home.

Horse manure is used almost exclusively for the making of hotbeds. It should be fresh and in the proportion of about two parts of solid excrement to one part of straw litter. (Shavings manure is unsatisfactory because it does not ferment rapidly enough.) The horse manure should be kept under cover in a square compact pile about 4 feet high, until heating or fermentation is well started. The piles should be turned and restacked when the fermentation is well under way and perhaps turned the second time before the manure is placed in the pit. Several days to a week may be required to prepare the manure properly for the pit. If it is too dry to heat satisfactorily, a few sprinkling cans of hot water may be added to advantage. The mistake should not be made of filling the pit until practically the entire mass of manure is thoroughly hot.

It is important to tramp and pack the manure as it is forked into the pit. The manure will settle several inches and allowance should be made for this. If the seed is to be sown without the use of flats or plant boxes, the manure should be covered with 4 to 6 inches of good soil, but 2 inches will be sufficient if flats are employed. Some growers do not use any soil on the manure, if the plants are started in boxes, but place the boxes directly on top of the manure. The frame of the hotbed should be kept banked to the top with strawy horse manure.

1. What are the advantages of a hotbed?

W-VG : 103. L: 60. C: 57.

2. Where should the hotbed be located? W-VG : 104.

3. What should be the depth of the hotbed pit? When should it be dug?

W-VG : 105. Tra : 51.

4. How should the frame be constructed?

W-VG : 106. L : 63.

5. Prepare estimate of lumber and nails needed to build your hotbed.

6. What size sash will you use?

7. What size hotbed will you need for your tomato project?

8. How much and what kind of manure will be required for your hotbed?

W-VG : 109. L : 60-62. C : 57.

9. Explain the preparation of the manure for the hotbed.

W-VG : 110.

10. Explain the filling of the pit.

W-VG : 110. L : 60-62.

11. How much soil should be placed on top of the manure?

12. How can you determine when the temperature of the hotbed and of the manure is suitable for sowing?

13. Should any manure be placed outside of the frame? Why?

14. *What chemical changes take place in the fermentation of horse manure?*

15. *To what extent can other vegetable matter besides horse manure be employed in the making of a hotbed?*

16. *Explain the construction of concrete hotbed frames.*

6. **Construction of cold frames.**—The cold frame is generally built on top of the ground, or perhaps a slight excavation is made,

but it is seldom that heat is provided, hence the name "cold frame." Extensive commercial growers often heat their frames with steam or hot water pipes, but in these instances the word "frame" is more properly applied than the term "cold frame."

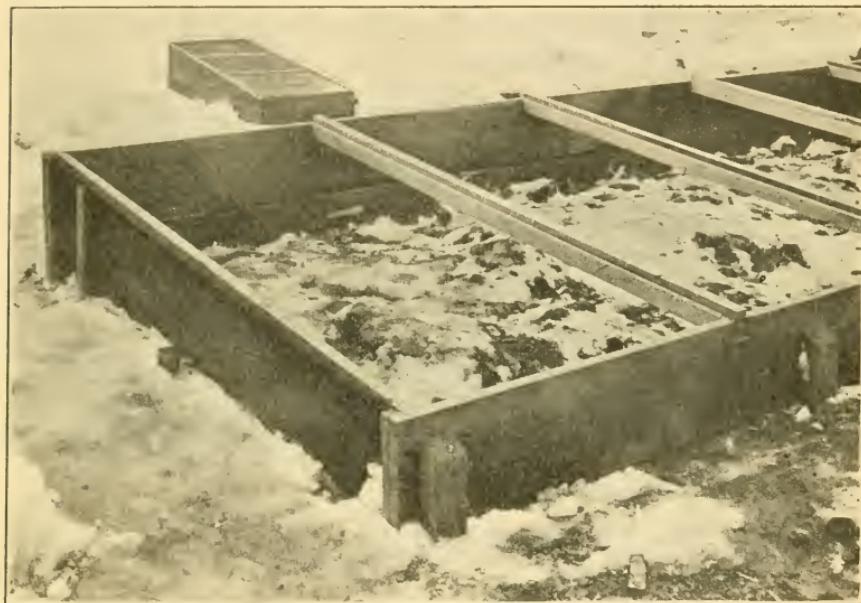


FIG. 3.—A well-constructed cold frame with narrow strips nailed on the cross pieces. A small hotbed back of the cold frame.

Cold frames, like hotbeds, should be located near the residence and near water, and there should be as thorough protection as possible from hard, cold winds.

The ground should be graded level before the frame is placed. This precaution is necessary from the standpoint of thorough and uniform watering.

If the tomato plants are to be set directly in the soil of the cold frame, special care should be taken in the preparation of the soil. (See page 63.)

The tomato seedlings should be kept in the hotbed until they are four or five weeks old and then transplanted, utilizing all of the hotbed as well as the cold frame.

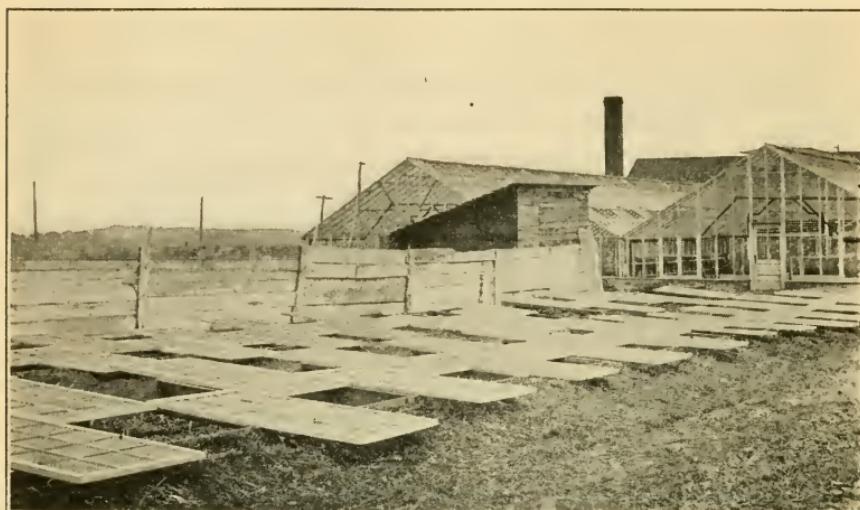


FIG. 4.—Cold frame well ventilated; board fence constructed for windbreak.

1. Where will you locate the cold frame?

W-VG : 14. L : 58.

2. How will you construct the frame?

W-VG : 114-117. L : 66. C : 55-57.

3. How will you prepare the soil? W-VG : 117.

4. Estimate material required to build the cold frame for your tomato project.

7. Making plant boxes.—When hotbeds and cold frames are employed in the starting of early vegetables, plant boxes, commonly called "flats," are practically indispensable. They are so

convenient and have so many advantages that gardeners who have once used them do not care to grow plants without them. One of the greatest advantages is that all of the work of seed sowing and transplanting of the seedlings can be done in a warm, comfortable room, regardless of weather conditions, and then the flats may be quickly conveyed to the hotbed or cold frame. When the plants are ready for the field or garden, it is again convenient to place the flats on a vehicle and transport them to the area where the plants are wanted.

Any kind of thin lumber may be used in making flats. Chestnut is very durable and with proper care the flats will last several years. Many gardeners make flats from various kinds of wooden boxes that may be obtained from retail merchants. Flats should be made of such dimensions that they will fit in the hotbed or cold frame with practically no loss of space. They are usually 2 to 3 inches deep; the length and width are extremely variable, though $16 \times 11\frac{1}{2}$ is a convenient size.

Flats when not in use should be kept under cover. They should be looked over annually and repaired whenever they need attention.

1. Do you intend to use flats in starting your early tomato plants?

2. What are the advantages of flats? W-VG : 152.

3. What kind of lumber may be used in making flats?
W-VG : 152.

4. What should be their dimensions for use in your hotbed and cold frame?

5. How many flats will be required to start your tomato plants?

6. Estimate lumber and nails required to make the flats you will need.
7. What are the relative merits of deep and shallow flats?
8. How should flats be cared for when not in use?
9. What does it cost to make flats?

8. Making straw mats. — Protection in addition to glass sash is often necessary on both hotbeds and cold frames. Of the various devices used for this purpose, rye straw mats are the most satisfactory. Either hand- or machine-made mats may be purchased from dealers or seed supply houses, or they may be made by hand at home. They are usually $4\frac{1}{2}$ feet wide \times 7 feet long, and from $1\frac{1}{2}$ to 2 inches thick. When not in use, mats should be kept in a dry place where rats and mice cannot damage them.

Straw mats may be made at home as follows: Make a frame of 2×4 inch planks the size of the mats desired. Drive heavy nails along one end of the frame about 6 inches apart. Strong cord, preferably tar cord such as is used for baling corn fodder, is the most durable tying material for use in the making of straw mats. A piece of cord is tied to each nail, stretched the length of the frame, then drawn through a loop of temporary cord on the inside of the opposite end of the frame, and pulled tightly. Two bundles of rye straw, each of a size that can be held conveniently between the thumb and finger, are then placed across the cords at the end of the frame, with the tops overlapping in the middle. The loose ends of the cords, which should be wrapped on spools, are drawn around the straw bundles and under the tightly stretched cords, making half-knots and drawn tightly; two more lots of straw are then placed on the cords and the operation repeated until the other end of the frame is reached, where the ends of the cords are tied together. The making of the

mats is completed by trimming the butts of straw along both sides of the frame. While the mat is being made, the frame should be stood on end and leaned against the side of room or building.

1. Will you need mats to protect your plants in the hotbed? Why?
In the cold frame? Why? W-VG: 154.
2. Explain the making of straw mats.
3. How should mats be handled and stored in order to make them last for the longest possible period?
4. Describe other kinds of mats that might be made or bought.
9. Sowing seed.—Soil for the starting of tomato plants should be stored in the fall of the year, so that it will not be in a frozen

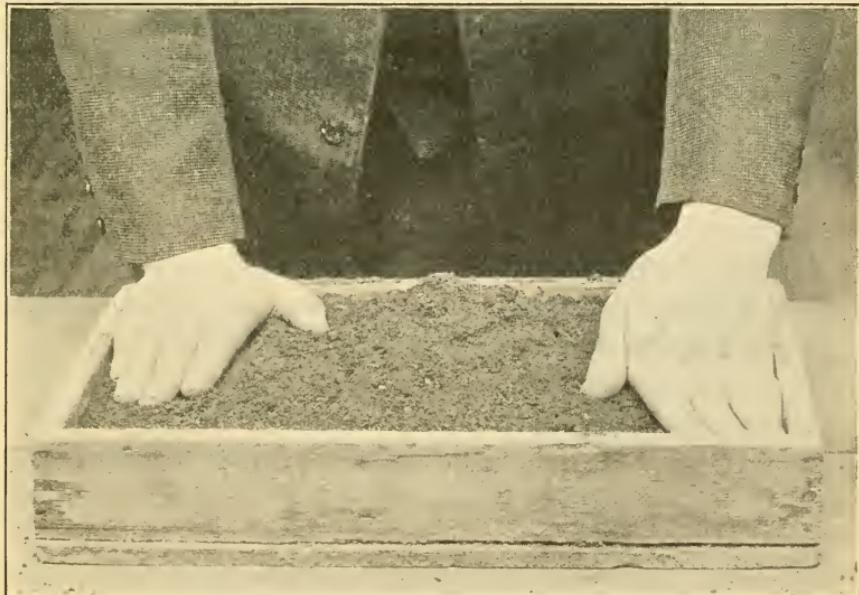


FIG. 5.—Firming the soil in preparation for seed sowing.

condition when wanted for use the following spring. Any good garden soil will be suitable for this purpose. It should contain considerable organic matter, commonly called humus, and a liberal proportion of sand. Market gardeners often prepare the

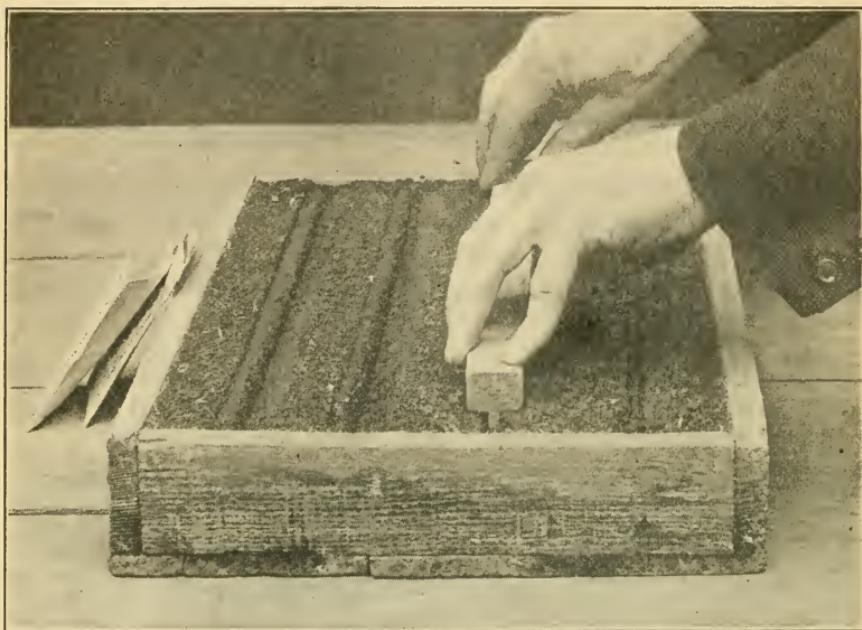


FIG. 6.—Marking the rows for seed sowing.

soil for the starting of plants by mixing about two parts of soil with one part of sand and one part of manure. Two to three pints of air-slaked lime to each bushel of soil will be found to be an advantage.

If the student will keep in mind that oxygen, heat, and moisture are required for the germination of all kinds of seed, he will be more likely to make a seed bed that will provide suitable conditions for germination.

The proper amount of moisture is especially important. This matter should have careful attention even before the seeds are

sown. Very dry soil may be quickly and easily moistened by sprinkling as it is turned or shoveled over.

As previously stated (W : 48) flats are very convenient for starting all kinds of early vegetable plants. Most growers prefer to

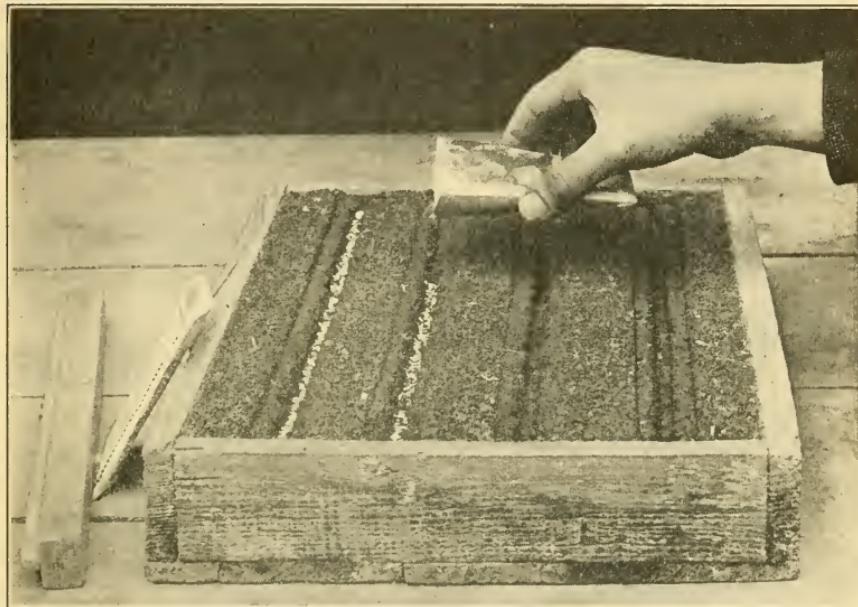


FIG. 7.—Sowing seed from an envelope.

sow the seed in rows rather than broadcast. The rows should be about two inches apart and the furrows one fourth to one half inch deep. It is customary to make the furrows with a straight, narrow strip of wood, such as a piece of lath, or marker (Fig. 6), which should be slightly shorter than the width of the flat. The seed should be carefully distributed in the furrow at the rate of about 12 seeds to the inch. Sowing may be done rapidly and uniformly with an envelope, held as shown in Fig. 7, or the seed may be distributed by taking a few at a time between the fingers. After the furrows are closed in any way most convenient to the gardener, the soil should be firmed with a block of wood and then

thoroughly watered. If the seed box is covered with heavy paper, evaporation will take place slowly and germination will be hastened.

The time of sowing will depend on the climate, varieties selected, and purpose of the crop. In most sections of the North, about March 1 to 10 will be found as early as it is expedient to sow in hotbeds. If Earliana, Bonny Best, Chalk's Jewel, and Matchless are sown at this time, a succession of fruit should be available from early in July until frost occurs in the fall.

1. What steps are necessary in selecting, storing, and preparing soil for starting early vegetable plants? W-VG : 130-131.
2. Explain sowing of seed in flats.
L : 244. W-VG : 133, 134, 151, 154, 456-458. Tra : 59-60.
3. Are you certain that your seed will grow? Why?
4. What is the proper time for you to sow?
W-VG : 131. W-VG : 456-458. L : 244.
5. How many flats must be sown to start enough plants for your tomato project?
6. What percentage of the seed should grow? How do you know?
7. What are the requirements for germination?
8. What is meant by the term "viable"?
9. What chemical changes occur in the germination of seeds?
10. Caring for the seedlings.—The most important factor in the growing of good tomato plants is the supply of soil moisture.

This must be carefully regulated by intelligent watering. If the soil was thoroughly watered after the seeds were sown, and covered with paper or burlap, little, if any, additional water will be needed until the plants are up, when the cover must be removed. Then the policy should be merely to keep the soil moist. Over-watering is always dangerous and should be carefully guarded against, for a surplus of water, especially if the temperature is a little high, is certain to result in weak, spindling plants. At the same time, we should guard against merely wetting the surface of the ground at frequent intervals. The boxes or beds should be looked after daily and water supplied in such amounts as may be indicated by the soil itself and also by the size and color of the plants — a light green color showing that too much water has been used. When paper pots are used, special care should be taken to avoid overwatering. It is always preferable to water in the morning when the temperature of the hotbed is rising, rather than in the evening when it is falling.

A temperature of about 70 degrees during the day and 10 to 15 degrees lower at night is suitable for the growing of early tomato plants. If there is bright sunshine, the temperature may rise considerably above 70 degrees, but no harm will be caused if the frame is properly ventilated.

Good judgment should be exercised in ventilating the hotbed and cold frame. Too much ventilation is just as objectionable as too little. The grower should observe the thermometer at frequent intervals and the frame should be opened in such a way as to avoid cold drafts of air on the plants.

Straw mats or other devices for covering the sash at night will be required to protect the plants. They should be placed on the sash before dark and removed early in the morning. However, the use of the mats should be regulated entirely by weather conditions. There are extremely cold days in the North when the mats should not be removed at all.

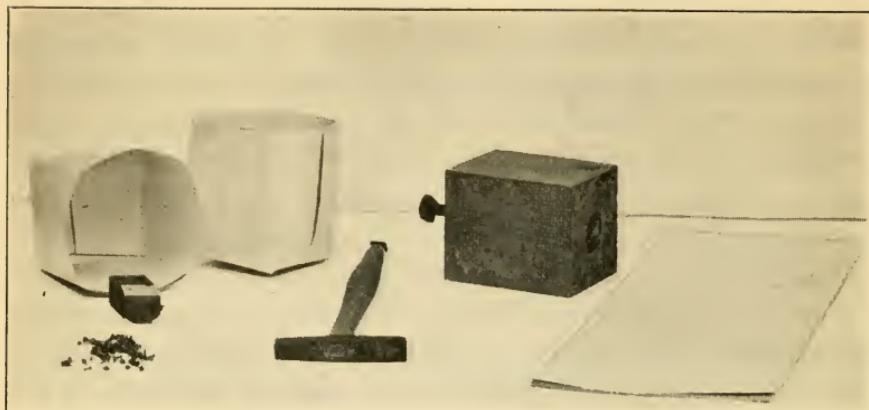


FIG. 8.—Equipment and material for making paper pots.

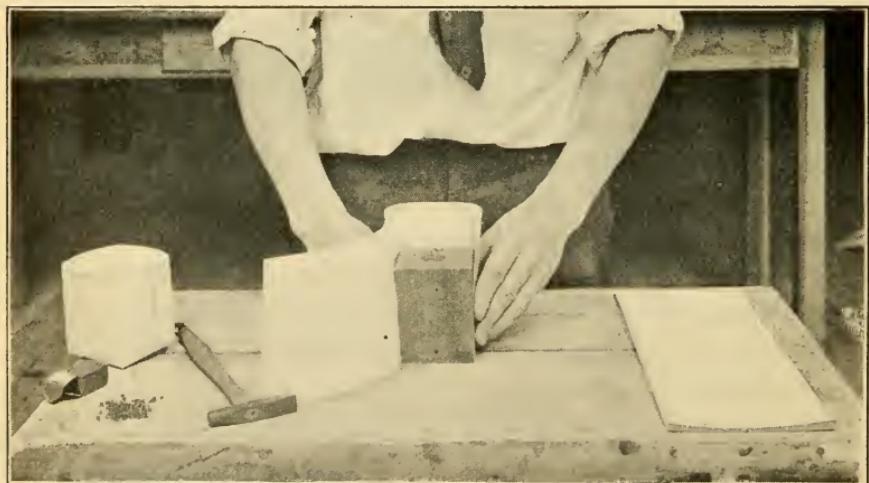


FIG. 9.—Folding the paper around the block which is secured to the bottom of a flat.

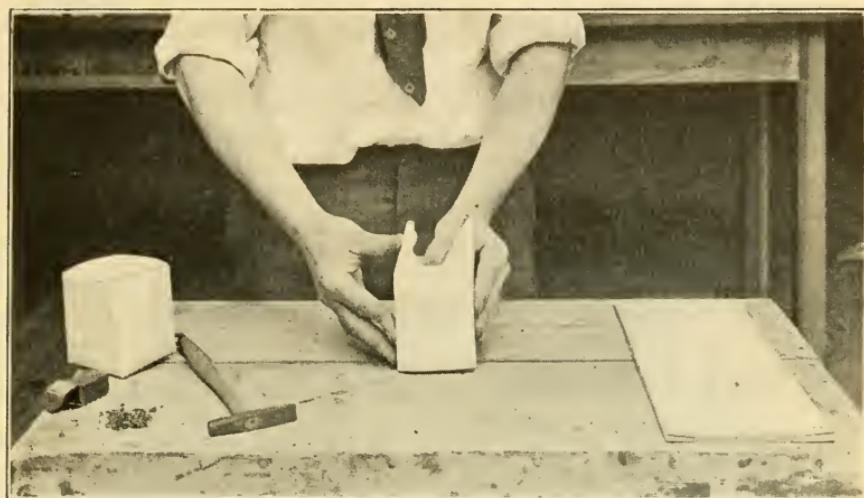


FIG. 10.—The paper is being folded over the top of the block in preparation for the use of a tack.

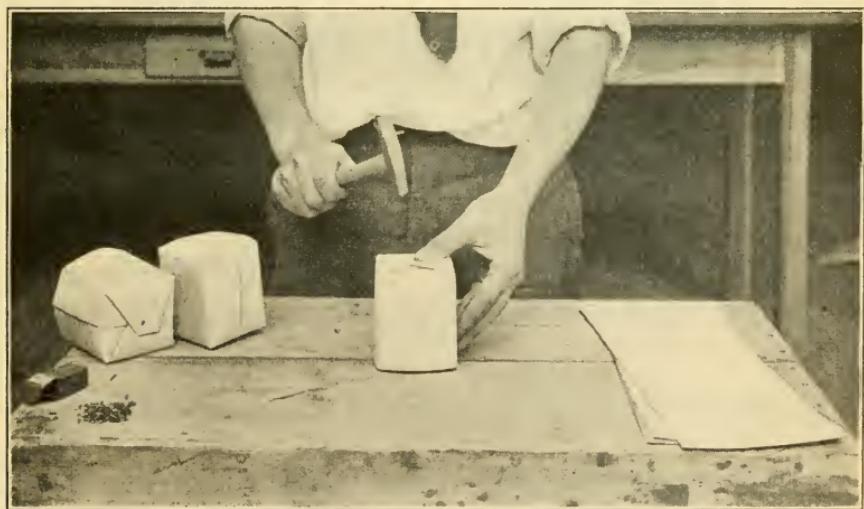


FIG. 11.—Driving a small tack through the folds of paper and over the end of a bolt that extends through the block.

1. What are the most important considerations in watering?
L: 68.

2. What is the proper temperature for tomato plants?
W-VG: 155. Tra: 62.

3. How should the hotbed or cold frame be ventilated?
W-VG: 157. L: 67.

4. Determine the equipment needed for watering.

5. Explain the use of mats.

11. Making paper pots. — Paper pots have been found to be very convenient and satisfactory for the growing of early plants, especially tomatoes. Though they are sold by dealers at reasonable prices, very good ones may be made at home at slight expense. A rectangular strip of fairly heavy paper, of the size required to make the pots desired, is folded around a square block, which is bolted through the center to a table. The paper is then folded in and clinched in the center with a single upholstering tack driven over the end of the bolt. (Ordinary heavy wrapping paper will be found entirely satisfactory for this purpose.) Plants grown in paper pots may be transferred to the open ground without any disturbance of the roots. The pots may be made during the winter in sufficient number to meet the needs of the spring planting.

1. What are the advantages of paper pots? W-VG: 160.

2. How are paper pots made? W-VG: 160.

3. Shall you use paper pots in your tomato project? If so, how many will be needed? What will they cost?

12. Transplanting. — There are various reasons for transplanting tomato plants. Perhaps the most important is the economy of space. A hotbed of very large size would be required to start enough plants for even an acre of land, if we sowed the seed thinly enough to provide space for the best development of the plants. In fact, it is not feasible to attempt to grow tomatoes,



FIG. 12.—Tomato plants in a paper and an earthen pot. Though paper pots are very useful, plants seem to thrive better in earthen pots.

especially under northern conditions, without shifting the plants once or twice before they are set in the field.

Tomatoes are generally transplanted when they are three to four weeks old. If they do not crowd each other too much in the hotbed, more time may be allowed. When they are to be transferred to cold frames, it is better to regulate the time of sowing and transplanting so that the plants will not be ready for the frame very much before the middle of April, though much will

depend on climatic conditions. For the home project, the safer plan will be to transplant into a hotbed. In this event, no more than a foot of hot manure will provide as much heat as will be required. In most parts of the North, it is entirely safe to set tomato plants in cold frames by the middle of April.

The same kind of flats that were described for seed sowing (W : 48

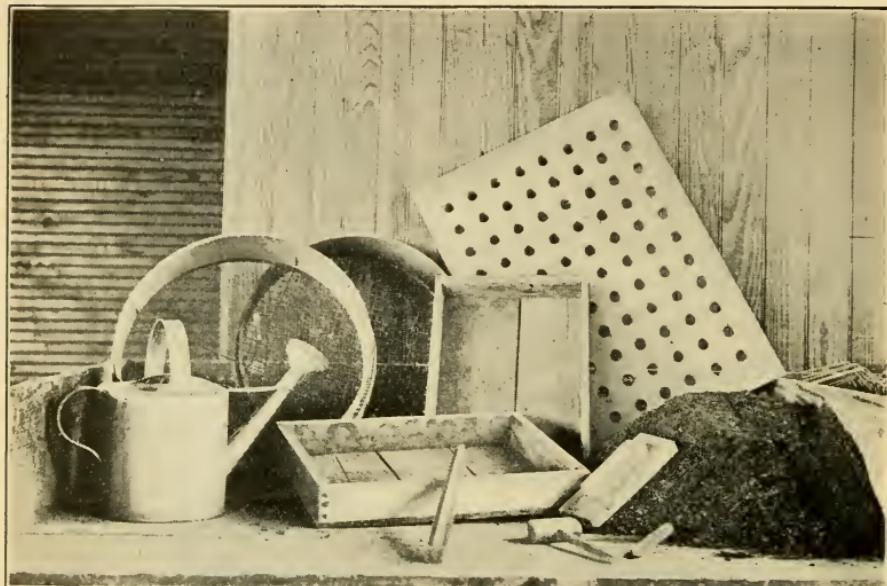


FIG. 13.—Equipment for seed sowing and transplanting.

and 53) will be found highly satisfactory when transplanting. The plants should be set about two inches apart. If they are to be kept in the frames more than two or three weeks, it will be a great advantage to make another shift into flats, spacing the plants at least four inches apart. Or, the second shift may be made into paper or earthen pots, berry baskets, or other suitable devices.

A transplanting board is an exceedingly useful device. It is made of inch boards large enough to cover the flats to be employed. Half-inch holes are bored in check rows two inches apart,

and a dibber with a shoulder, to regulate depth, is used to make the holes in the soil by thrusting it through the holes of the transplanting board. The rows of plants will then be perfectly straight and the number of plants in each flat will be uniform.

The soil described for the seed bed (W : 52) will also be satisfactory for this purpose. It should be fine and moist enough to work well. The most important point to keep in mind when transplanting is that, in order to make this operation successful, the moist particles of soil must be brought into close contact with the fine, tender roots.

Unless the soil is very moist, at least some water should be applied after the plants have been set, and the flats must then be placed in the hotbed or cold frame, where they should receive practically the same treatment as that recommended for the small seedlings (W : 54).

1. What are the reasons for transplanting tomatoes ?

W-VG : 139. L : 49.

2. When should tomato seedlings be transplanted ?

W-VG : 155. L : 49.

3. How far apart should the plants be set ?

4. Explain the details of transplanting.

5. Prepare a statement of the equipment required to care for your tomato plants after they have been removed from the hotbed.

6. Do you think flats should be used when transplanting? Why?

7. Will it pay to use a transplanting board? Why?

8. Do you think any of your plants should be set in pots or berry baskets? W-VG : 457.

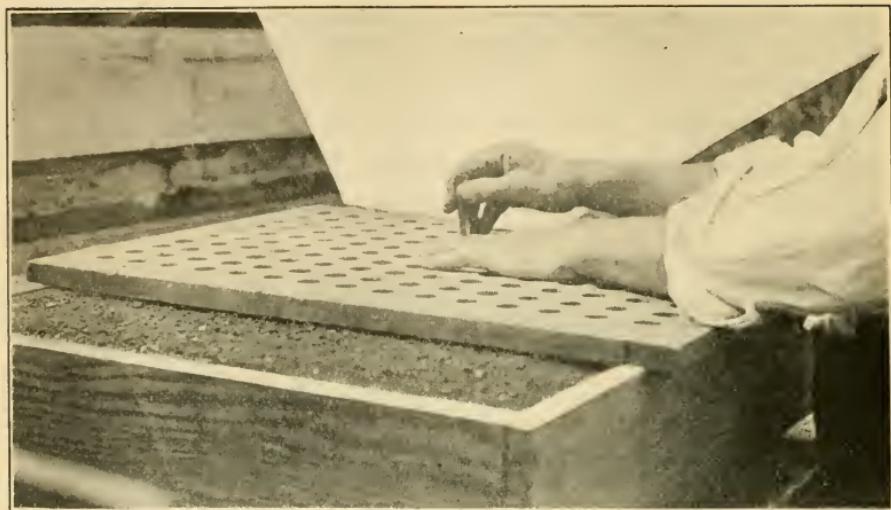


FIG. 14.—Using the transplanting board.

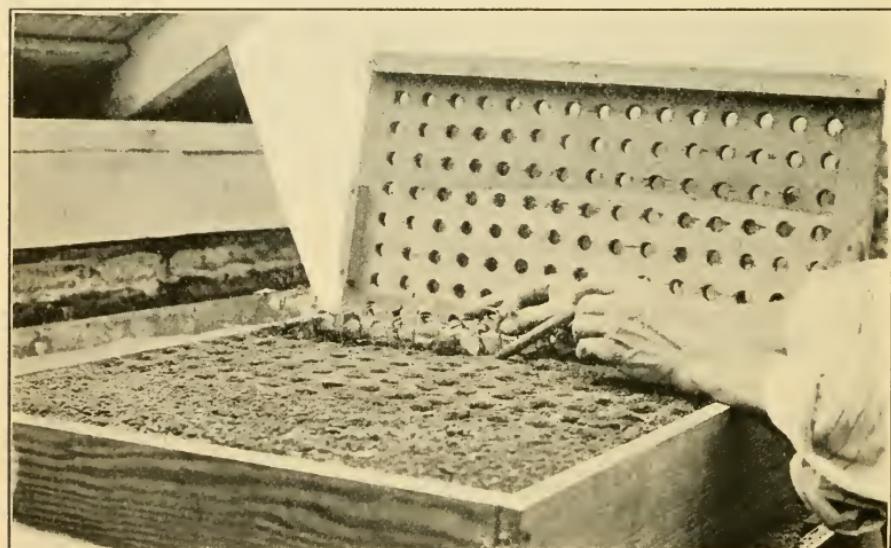


FIG. 15.—Holes made by the use of a transplanting board and dibber; also a small dibber used in firming the soil about the roots.

9. *What is the character of tomato roots?*
10. *Is the root pruning caused by transplanting small seedlings an advantage or a disadvantage? Why?*

13. Hardening the plants. — When tomato plants are kept in a warm forcing structure of any kind, with an abundant supply of soil moisture, they become very tender. If transferred to the open air when in such a succulent condition, they are easily injured or even killed by light frost, drying winds, or hot sunshine. Disastrous results from these causes may be avoided to a large extent by giving the plants a certain amount of ill treatment, so to speak, before they are transplanted into the open ground. Water is withheld after the plants have attained nearly the size desired, even if they wilt somewhat. Much more air is admitted to the frames, and on warm days the sashes are removed entirely. This kind of treatment for about a week has the tendency to make the plant tissues less succulent and more firm, so that they will stand rather severe weather conditions in the field. Millions of plants are lost annually because this matter is not given careful attention. Even the most thoroughly hardened tomato plants will not survive severe frosts, but they will stand light frosts, hard winds, and dry weather if properly planted.

1. **What is meant by the hardening of plants?** W-VG : 159.
2. **How is hardening accomplished?** W-VG : 159.
3. **What is its importance?** W-VG : 159.

14. Preparing the garden soil. — There is an erroneous idea among growers of limited experience that this vegetable does not require high fertility. It is true that small crops of tomatoes

may be obtained on soils that would fail to produce a marketable crop of celery or other vegetables that require the most exacting conditions. But large yields may be secured only from soils well filled with plant food and organic matter.

The tomato is often grown in rotation with other vegetables. A limited area of land may make this necessary. It is a great advantage, however, to precede the crop with clover, cowpeas, vetch, soybeans, or some other general farm crop, and preferably a legume that will add to the stock of nitrogen in the soil as well as to the supply of humus. A heavy sod of any kind of clover, plowed late in the fall or early in the spring, furnishes ideal soil conditions for the growing of tomatoes. It will be seen from these statements that the work of soil preparation may begin a year or more in advance of the actual planting of the tomatoes.

A common mistake is to defer the plowing of the ground for tomatoes until nearly planting time, which may be the cause of a greatly reduced supply of soil moisture and of unfavorable physical conditions.

A harrow should be used until the soil is fine and level. The heavy sods are best pulverized with a disk or cutaway harrow. In small gardens the soil may be put in good condition by thorough spading and careful raking.

Fresh stable manures should never be employed for the growing of tomatoes. Their application in considerable amounts is certain to result in excessive plant growth and a small crop of inferior fruit. Well-decayed animal manures of all kinds may be used for this crop with entire safety, and, if thoroughly decayed, there is practically no danger of applying too much. In only moderately fertile soils it is an advantage to place a shovelful of rotten manure in each hill. The usual plan is to apply fresh stable manure to the crop that precedes the tomato and little, if any, manure for the tomatoes.

It is rarely that the grower will not find it an advantage to fer-

tilize the tomato with some form of phosphorus. The usual practice is to employ the treated phosphatic rock, acid phosphate, containing about 16% of available phosphoric acid. An application of 500 to 700 pounds to the acre is probably as much as can be used to advantage on any soil. If potash is available at reasonable prices, it might also be used at the rate of about 100 pounds to the acre. Nitrogen may also be needed, and, if so, nitrate of soda, 50 to 100 pounds to the acre, may be the cheapest source. Heavier applications of fertilizer are required with close setting and staking.

All fertilizers should be applied after the ground is plowed, and mixed with the soil by thorough harrowing. Small amounts of nitrate of soda are sometimes used as a top dressing around the plants, but thoroughly mixed with the soil with a hoe or cultivator. A teaspoonful to each plant will be ample in quantity. The best method, however, is to apply all of the fertilizers before the plants are set in the field.

1. Does the tomato require a very fertile soil?

W-VG : 458. C : 438.

2. What crops should precede the tomato?

W-VG : 458. W-VG : 53. L : 27-30.

3. When should the land be plowed?

W-VG : 458. W-VG : 29. V : 71-73. Sp : 39-45.

4. What should be the depth of plowing?

5. What implements will you employ in preparing the soil?

W-VG : 30-34. C : 29-34. V : 63-74.

6. Should fresh stable manure be applied for tomatoes?

W-VG : 458. Sp : 102.

7. Should you use phosphorus? nitrogen? potassium?
W-VG : 459-460, 59-62. C : 438-439. Tra : 43-45.
Sp : 155-161.
8. How and when should the fertilizer be applied?
W-VG : 499, 67-68. C : 438-439. Tra : 43-45.
9. Estimate the fertilizer materials you will need and determine their cost.
10. Will home mixing pay? How is it done?
W-VG : 69. V : 215-218, 240-241.
11. Give the most important reasons for the rotation of crops.
12. Discuss the time of plowing and harrowing in relation to soil moisture problems.
15. **Planting in the garden.** — We must not be too ambitious in regard to the early planting of tomatoes. We should never lose sight of the fact that this is a tender vegetable and that frost and cold weather may kill the plants or at least seriously injure them. The safer plan is to be patient and wait until there is little danger of frost before risking the plants in the open ground. In most sections of the North, it is unsafe to set out the plants before May 20; even June 1 is not too late in some localities. If the plants are in the field or garden and there is danger of frost, a simple and effective method of protection is to cover them with soil. At first thought this may seem like rough treatment, but when we note the splendid condition of the uncovered plants the method appeals to us very strongly. It consists in drawing a mound of soil with a hilling hoe against the stem of the plant, carefully bending the plant over the mound and covering it with an inch or two of soil. The whole operation requires only a few moments to each plant. If the weather continues cool, the plants may be left covered for two or three days.

The proper planting distance will depend on a number of factors, but ordinarily 4×4 feet will be found satisfactory. Less space may be allowed if the soil is not very productive. If the plants are to be tied to stakes and pruned to several stems, they may be set 2×4 feet apart, and if to be trained to single stems 15 inches × 3 feet will give good results.

The plants should be removed from the flats or pots with care, so that the roots will not be disturbed or broken unnecessarily. Holes amply large are made with a hoe, and the moist soil pressed firmly over and around the ball of earth and roots. If the plants are stocky and well hardened (W : 63) and properly transplanted, practically every one should live, even if the weather is not entirely favorable for transplanting.

When growing tomatoes on a large scale it is more convenient and less expensive to make furrows for the plants with a plow instead of holes with a hoe.

1. When should tomato plants be set in the open ground?

W-VG : 141, 460. L:49.

2. How far apart should they be planted?

W-VG : 460.

3. What are the most important factors in transplanting? Name some good methods of transplanting.

W-VG : 141-150. L:49-57. C:39-41.

4. How may the plants be protected from frost?

16. Companion cropping. — When two or more vegetables are grown together on the same plot of ground, the system of cropping is known by various terms, such as companion cropping, double cropping, and intercropping. There are so many successful combinations that no attempt will be made here to describe more than one plan, but we would urge the student grower to look

into the matter. One of the best is to plant dwarf peas as early as possible in the spring, and then to set tomato plants three or four feet apart a few inches from the rows of peas. The peas, of course, will be well advanced before the tomato plants are set out and in a few weeks the pea vines may be pulled and the ground devoted exclusively to the tomatoes.

1. *What is meant by companion cropping?*

W-VG : 475. L : 260, 262.

2. *What are the advantages and disadvantages of companion cropping?*

W-VG : 475. L : 262. C : 5-6.

3. *Describe several combinations including the tomato.*

W-VG : 483, 484, 486. L : 261-262.

4. *Will it pay you to practice companion cropping? Why?*

17. Cultivation. — A fine, loose surface mulch of soil should be maintained in the tomato plantation as long as it is possible to use a cultivator between the rows. The importance of tillage has been shown in connection with plowing (W : 64). Not only do weeds grow when the cultivators are not used, but the soil soon becomes compact, soil moisture escapes at a rapid rate, and both the physical and chemical properties of the soil soon become unfavorable for plant growth.

Numerous types of cultivators may be employed, but the ones with a relatively large number of small teeth are generally better than those with a few large shovels. Tomatoes are usually cultivated with horses, but the soil of the home garden may be stirred very rapidly with a good wheel hoe.

Very little hand hoeing will be required if the wheel or horse-cultivators are used frequently and skillfully.

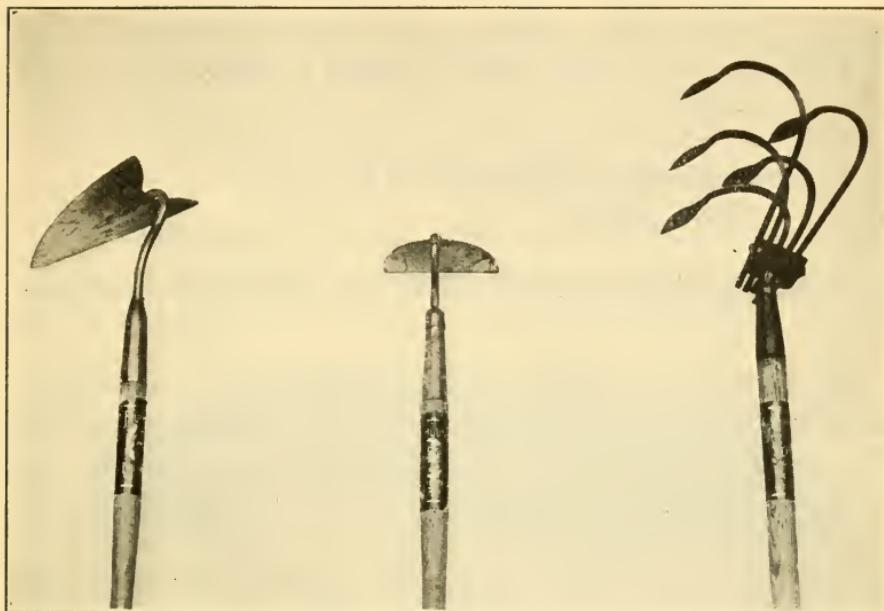


FIG. 16.—Inexpensive garden tools of special value.

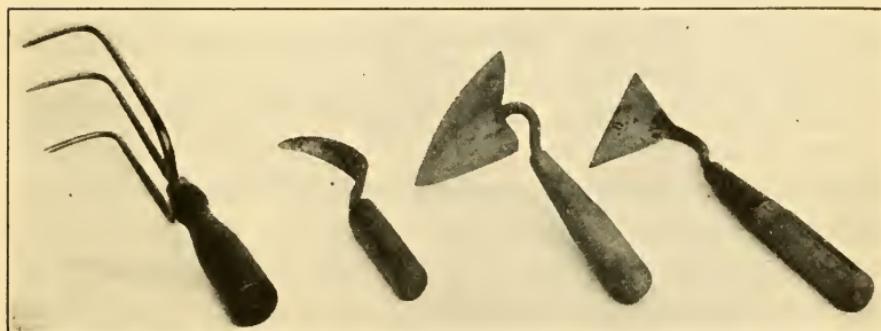


FIG. 17.—Hand tools useful for weeding, making furrows, and transplanting.

1. What is the importance of cultivation?

W-VG : 28. C : 21. Tra : 76. Sp : 60-73.

2. When and how often should tomatoes be cultivated?

L : 246.

3. What cultivating implements will you need?

W-VG : 34-40.

4. What is the relation of tillage to the conservation of soil moisture?

18. Training the plants. — An exceedingly small percentage of tomato growers give any attention whatever to training or pruning. The usual plan is to set the plants 3 to 5 feet apart each way and to let them make a spreading growth on the surface of the ground.

A few commercial growers and many home gardeners prefer to set the plants about 2×4 feet apart. A strong stake 6 feet long is driven at each plant when it is set out, three or four of the strongest branches are tied to the stake, and the others are removed before they have made much growth. This is a highly satisfactory method. There is probably no curtailment in the yield of each plant and twice as many plants may be set to the acre as when they receive no training. We must be assured, of course, of the labor required to do the staking and training.

Single stem training is universally employed in the greenhouse culture of the tomato, and it also finds favor among many home gardeners. It consists of pinching away all lateral shoots, thus making a single stem, which may be tied to a stake or to a wire trellis. The finest specimens are grown by the single stem system but it requires considerable labor.

1. What are the advantages and disadvantages in training tomatoes?

W-VG : 461. L : 246. Tra : 79.

2. *Describe the systems in common use. What are their comparative merits?*
W-VG : 461-463. L : 246-248. Tra : 79-89. W-VF : 280-284.
3. *Will it pay to train your plants? If so, what system will you use?*

19. Combating insects and diseases. — The solanaceous crops, like other closely related groups, comprise a number of plants, which are attacked by the same species of insects. These indi-

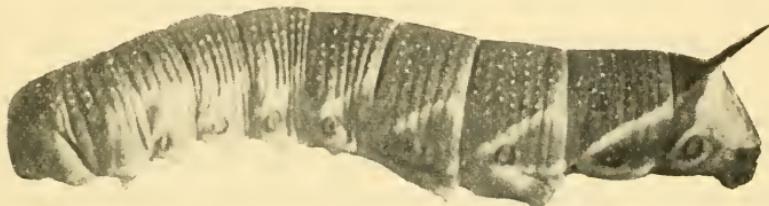


FIG. 18. — Tomato worm.

viduals so readily adapt themselves to the different hosts that their habits are apparently unchanged and in each instance similar control measures are ordinarily practiced.

The potato flea beetle is perhaps the most serious pest of the newly set tomato, pepper, and eggplant. Leaves riddled with very small round holes like fine shot, accompanied with small glistening black beetles that jump when disturbed, identify the insect and its work.

The adult beetles pass the winter in rubbish, emerging in early spring to feed on plantain or similar weeds until the cultivated plants appear above ground or are transplanted. Eggs are deposited in the soil near the plants and from these hatch very small grubs that feed on the roots, often causing serious injuries to tubers or stunting the plant growth.

Control: Bordeaux mixture. CL: 317.

1. Describe flea beetle work and how its feeding affects the plant.
CL:314-317.
2. Name several plants attacked by the insect.
CL:314-315.
3. What is the life history of the flea beetle?
CL:314-316.
4. Can flea beetles be killed by poison? What is the best spray and how does it act?
CL:317.
5. How is Bordeaux mixture prepared?

Two species of tomato worm, the southern tomato worm and its relative, the northern tomato worm, feed extensively on tomato plants or in a lesser degree on eggplant foliage throughout their respective areas. They are large greenish or brownish caterpillars having at the rear end of the body a somewhat curved, sharp horn. Feeding by these caterpillars is most extensive on the tomato, where they work in the dense foliage, often detected only by excreted material covering the ground beneath the plant.

The adult, an ashy gray moth, deposits single eggs on the under side of the leaves. From these the young caterpillars hatch and in about a month mature and enter the ground to pupate. There may be several generations each year, depending largely on seasonal conditions or the degree of latitude.

Control: Hand picking or spraying.

1. How can the tomato worm be most easily recognized?
CL:159.
2. Give briefly the life history of the species. Describe any differences.
CL:169-171.

3. *What injury do they cause and how may it be detected?*

CL: 171.

4. *Name two control measures.*

CL: 171-172.

Tomatoes are subject to several diseases, such as early and late blight, which are the same as those that attack its closely related plant, the potato. Both the early blight and the late blight attack the foliage of the tomato, killing it and thus reducing the crop or causing complete loss. The late blight also attacks the fruit in the fall, causing it to decay in much the same manner that it causes decay of potato tubers. Another very common disease of tomatoes is known as Septoria leaf spot. This disease attacks not only the foliage but also the stems, causing a circular gray spot. It does not attack the fruit directly. These three diseases can be controlled by spraying the plants at a timely period and in a thorough manner with Bordeaux mixture. Various formulæ of Bordeaux are effective as sprays for these diseases, but for general use the standard 4-4-50 formula is satisfactory. Spraying should be started as soon as the plants are established in the field. In the cooler climates two applications are most profitable for early blight and leaf spot. In the warmer climates below the Mason and Dixon line about five applications are more economical. Where late blight is a factor two or three late applications are necessary, starting when the first fruits are beginning to ripen.

Winter blight is a destructive disease which is most commonly met with in growing tomatoes under glass. It produces a brown streaking of the stems and a fine, brown spotting of the leaves. The fruits are also attacked and exhibit a brownish, blotched appearance, which appears to be confined chiefly to the skin. The disease usually kills the plants within two or three weeks.

after they are attacked. It may be checked by thorough ventilation and avoidance of overwatering. The application of potash also seems to check the disease to some extent. Inasmuch as it is spread by infected seed, great care must be exercised in selecting the fruits from which seed is to be taken. The diseased seeds may be detected by cutting open the ripened fruits and examining for brown or blackish spots. If spots are present on even a few seeds such fruits should be discarded.

Damping off and root-rots are diseases caused by fungi, which live in the soil and attack the tomato plants while they are in the seedling stage or before they are fully established in the field. They are most destructive as seed-bed diseases and as such may be controlled by sterilizing the soil in the seed bed each year with steam or formaldehyde. They are most often brought on by overwatering the young plants, and the condition can be partially corrected by limiting the water supply.

Wilt or sleepy disease is an extremely destructive disease which is most prevalent in the warmer climates. It is caused by a fungus, *Fusarium lycopersici*, which lives in the soil and attacks the plants through the roots. The vascular system of the plant is invaded and the supply of water thus limited, which causes the plants to wilt. Several strains of tomatoes have been developed which are highly resistant to this disease. Among such varieties are Marvel, Arlington, and Columbia, which are well worth growing where wilt is a factor in tomato production.

There are several fruit rots that attack the tomato late in the season. They are caused by various fungi, which are favored in their attack by injuries that break the epidermis. Keeping the patch clean of old plant refuse and training the plants on stakes to keep the fruits off the ground are the best means for combating these troubles.

Blossom end rot is a common disease, characterized by a dry decay, which always starts at the blossom end of the fruit.

Unequal moisture content of the soil is the most common predisposing factor bringing on the disease. It is therefore advisable to regulate watering as carefully as possible. A light mulch or frequent cultivation tends to regulate the moisture content of the soil and lessen this trouble.

1. What other crop do some of the diseases of tomato affect?
Why?
2. Why do foliage diseases reduce the amount of fruit?
3. What diseases are controllable by spraying with Bordeaux?
4. How should winter blight be treated? In what way may the seeds of tomatoes be selected to eliminate disease?
5. What conditions are favorable to the spread of the fungi causing "damping off"?
SH: 14-21.
6. What effect do steaming and formaldehyde treatment have upon these organisms?
SH: 460-465.
7. What relationship exists between climate and certain tomato diseases?
8. Of what value is sanitation in the control of disease?
SH: 16-17
9. What can be done to lessen the amount of blossom end rot?
SH: 263-264.

20. **Harvesting and marketing.** — Tomatoes are always better in quality if allowed to become fully ripe before they are picked. This is possible for the home table, but when the fruits are hauled

or shipped considerable distances to market, it is important for them to be only partially ripe, depending upon the length of time that will probably intervene before they reach the table of the consumer.

Tomatoes should always be handled with care in order that there may be no unnecessary bruising. If they are to be

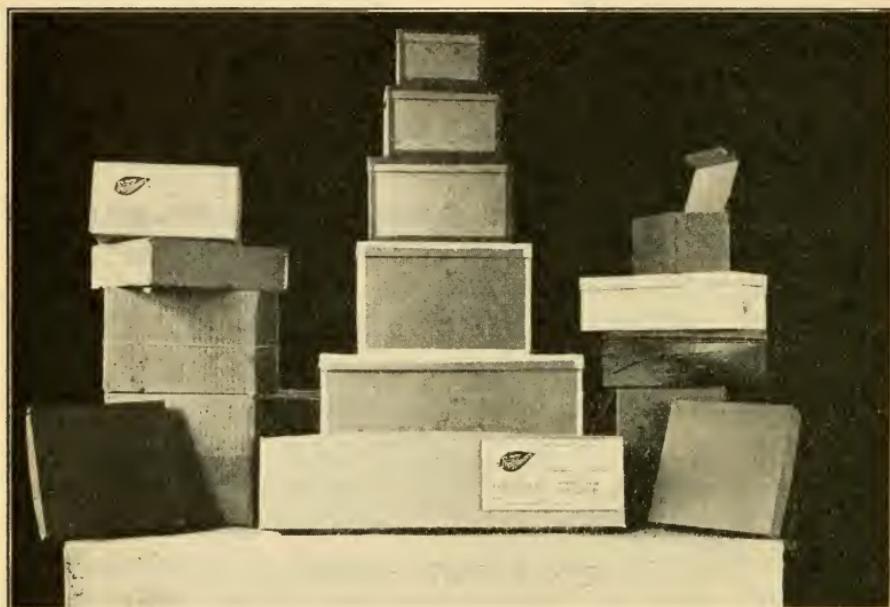


FIG. 19.—Assortment of parcel post packages.

marketed, they should be thoroughly cleaned, preferably by wiping with a damp cloth; their stems removed; graded; and packed neatly and artistically in clean, attractive packages.

Many forms of packages are employed for marketing tomatoes. In most instances it is desirable to use the package preferred by the markets to be supplied.

Probably the average yield of tomatoes in the United States is less than 100 bushels to the acre, but this is a very small crop

and intelligent growers ought to do much better. Thousands of gardeners obtain yields of much more than 100 bushels to the acre. In fact, 500 bushels, or 12 to 15 tons, to the acre is not an unusual yield, and with good management this is not a difficult achievement.

1. When should tomatoes be picked?

W-VG : 162-165. C : 440-441. Tra : 90-92.

2. How should they be prepared for market?

W-VG : 166-168. C : 441. Tra : 92-96.

3. What is the best method of packing for your market?

W-VG : 168-176. L : 292. C : 441. Tra : 92-96.

4. How will you grade your tomatoes?

5. What kind and how many packages will you need to market your crop?

W-VG : 168-174. Manufacturers' catalogues.

6. How many bushels or tons of tomatoes should an acre produce?

7. What does it cost per acre and per ton to grow tomatoes?

8. Can you suggest a special plan for marketing that might increase your profits?

Project II. Growing Eggplants

The eggplant is an annual herbaceous plant finally becoming somewhat woody. It belongs to the potato family. The leaves are simple, large, thick, and sinuately lobed. The fruit is a large berry, smooth, and variable in color. The genus is a native of India and all cultivated varieties require high temperature for satisfactory growth.

1. To what plants is the eggplant related?
2. What is the nature of the fruit of the eggplant?
3. What climatic condition is favorable for the growth of the eggplant?

Project Outline

1. Importance of the crop.
2. Selecting location.
3. Choosing varieties.
4. Starting plants.
5. Preparing soil.
6. Planting in the garden.
7. Combating insects and diseases.
8. Marketing.

1. Importance of the crop. — The eggplant is not comparable in importance to the tomato, either for the home table or for

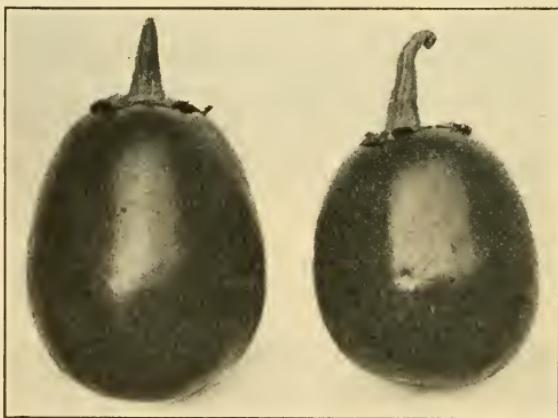


FIG. 20.—New York Improved eggplant.

market. Nevertheless, some people are extremely fond of this vegetable and good specimens generally command attractive prices.

Market possibilities should be investigated before undertaking the culture of eggplants on a commercial scale.

1. *What is the importance of the eggplant?* W-VG : 339. C : 259.
2. *Where is it grown most extensively?*
3. *Do you think it would pay you to grow eggplants? Why?*
4. *What is the history of the eggplant?*
5. *How does it differ from the tomato botanically?*
6. *How is it prepared for the table?*
7. *Dissect and carefully study the fruit.*

2. Selecting location. — The eggplant is far more exacting in its cultural requirements than the tomato. It demands higher temperatures for the best results and thrives only in well-drained soils fully supplied with vegetable matter and plant food. Sandy loams are best adapted to the growing of eggplants. In the North, where the climate is not ideal for this crop, special care must be exercised in the selection of the most suitable soils.

1. **What kind of soil is best adapted to growing eggplants?**
2. **What are the climatic requirements?**
3. **What is the best exposure?**

W-VG : 340. L : 251. C : 261.

3. Choosing varieties. — Eggplants may be almost black in color, or purple or white. The most popular market varieties are New York Improved, Black Beauty, Black Pekin, and Early

Long Purple. The last-named variety is very early and suitable for cultivation under conditions which would be most unfavorable for the later larger-fruited sorts.

1. How do eggplants vary in size, color, shape, and earliness?

W-VG : 339. L : 252. C : 260-261.

2. What varieties do you think it will be best for you to grow?

W-VG : 339. C : 260-261. Seed catalogues.

4. Starting plants.—Eggplants are started and handled very much in the same manner as tomato plants, but they require at least 10 degrees higher temperature in order to insure rapid growth. The plants cannot be cared for satisfactorily in cold frames and unless a greenhouse is available it is necessary to have two hotbeds, one for the germination of the seed and care of the very young plants, and the other, made about four weeks later, to accommodate the plants after they have been removed from the seed bed. The seed is ordinarily sown from March 1 to 15 and the plants are often shifted to pots before they are taken to the field.

1. What equipment is needed to start the plants? W : 43-58.

2. When should the seed be sown?

W-VG : 341. L : 251. C : 261.

3. What temperature is required?

W-VG : 341. L : 251. C : 261.

5. Preparing the soil.—The greatest care should be taken in preparing the soil for eggplants. There should be no doubt about the soil having an abundance of vegetable matter and available plant food.

1. How should the soil be prepared for eggplants?

W : 79. W-VG : 342. C : 261.

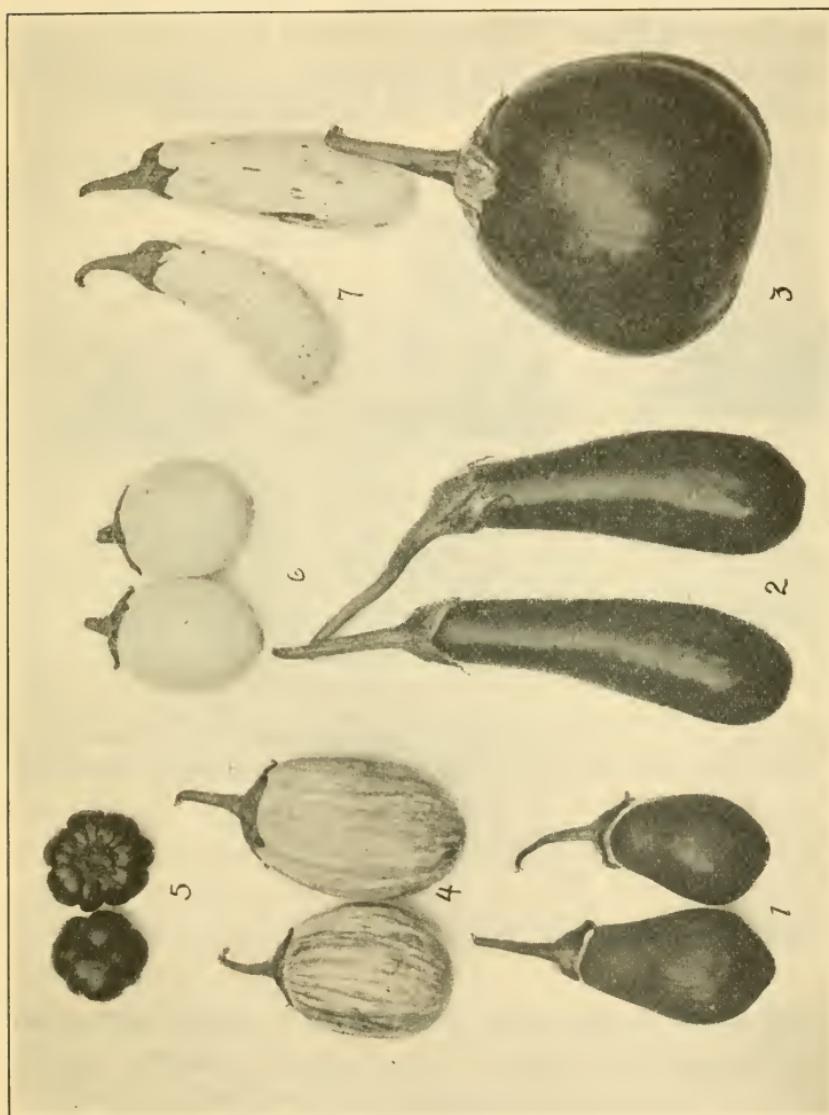


FIG. 21.—Various types of eggplants; they vary greatly in color, size, and shape.

6. Planting in the garden. — Eggplants should not be set in the open ground until the weather is quite warm and there is no further danger of frosts. In most sections of the North, it is not desirable to plant in the field before June 1. They should be shifted with as little disturbance of the roots as possible.

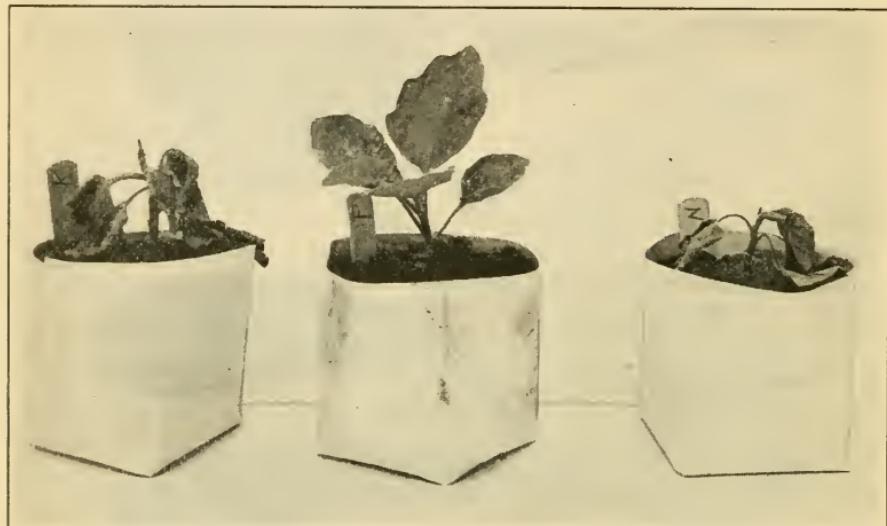


FIG. 22.—The two wilted eggplants have been treated with too much commercial fertilizer. The safer plan is to fill the pots with soil well enriched by the use of decayed manure and not to apply any chemical fertilizer as top dressing.

1. When should eggplants be set in the garden?

W-VG : 341-342. L : 251.

2. How far apart should they be planted?

7. Combating insects. — Potato beetles and flea beetles are the most destructive enemies of the eggplant and they may be controlled by the methods generally employed for these pests.

1. What insects and diseases attack the eggplant and how may they be controlled? W : 217. L : 253.

8. Marketing. — The fruits should be packed in clean, attractive crates or baskets. Sometimes they are wrapped in tissue paper.

1. How should eggplants be marketed?

2. What are the chances for profit?

Project III. Growing Peppers

Peppers belong to the potato family. In cultivation the common pepper behaves as an annual, but in warm climates it is often biennial. The species is not known in the wild state, but it is generally believed to be a native of tropical America.

Peppers form erect plants that may become woody at the base. The leaves are comparatively small and entire. The fruit is a berry, red, yellow, or green in color, and varying in shape from globular to heart-shaped and cylindrical. The seeds are numerous. The principle imparting the pungent taste is known as *capsaicin*, which is located in the smaller varieties in the fleshy part of the fruit and in the larger ones chiefly about the seeds. Cayenne pepper is made by grinding up the whole fruit. In the squash varieties, which are used as "mangoes," the fleshy part of the fruit is of a mild flavor. Peppers are used as condiments and food, and some varieties are used for ornamental purposes. The numerous commercial varieties may be placed in seven botanical varieties or types, distinguished especially by the size, shape, and other characteristics of the fruit.

1. What is meant by the terms annual and biennial as applied to plants?

2. How do pepper fruits vary?

3. Where is the peppery taste located?

Project Outline

1. Importance of crop.
2. Selecting location.
3. Choosing varieties.
4. Starting plants.
5. Preparing soil.
6. Planting in the garden.
7. Harvesting and marketing.

1. Importance of the crop. — The pepper is becoming of increasing importance in all sections of the country. There is a large demand for the sweet-fruited type, commonly called mangoes, which sells at prices that entitle the crop to serious consideration from a commercial viewpoint. While it thrives best in the South and in the light soils of the Atlantic Coast region, it may be grown successfully throughout the North.

1. Will it pay you to grow this crop for commercial purposes?
How do you know? W-VG:414. C:341.

2. Where would you sell it?

3. How does it differ botanically from the tomato and eggplant?

4. What is the history of the pepper?

5. Make a careful study of the fruit.

2. Selecting location. — The deep, fertile, light, sandy loams are best adapted to the growing of peppers. However, they may be grown successfully in all well-drained soils that are properly provided with organic matter and plant food.

1. Have you a suitable location for peppers? If so, what are its advantages? W-VG:414.

3. Choosing varieties. — Peppers are divided into two classes, namely, those which bear small, pungent, hot fruits and those which produce large, mild fruits. Long Red Cayenne and True Red Chili are probably the best known of the former type and



FIG. 23.—Peppers are erect in habit of growth and may be planted fairly close together.

Ruby King, Chinese Giant, and Neapolitan are favorites in the sweet class.

1. What varieties would you select? Why?

W-VG : 415. Seed catalogues.

2. How do peppers vary in size, shape, color, and pungency?

4. Starting plants. — The plants are started in the same manner as tomatoes, but they do not grow so rapidly and for this reason

it is desirable to sow somewhat earlier than tomatoes. The seed is slow to germinate.

1. How should the plants be started? W: 44-63.

2. Will it pay to grow them in pots? Why? Or, why not?
W: 58.

5. **Preparing soil.** — The soil should be prepared with the same care and thoroughness as for a heavy crop of tomatoes.

1. How should the soil be prepared and fertilized for this crop?
W: 63.

6. **Planting in the garden.** — The plants should not be set in the garden until there is no further danger of frost. They should be spaced 15 to 18 inches apart in the row and there should be not less than 30 inches between rows if a horse cultivator is to be used.

1. When should peppers be planted in the garden?
W: 66. W-VG: 416.

2. What are the proper planting distances? W-VG: 416.

7. **Harvesting and marketing.** — Peppers do not require the prompt harvesting necessary with tomatoes. Sometimes the market wants them in a green state. At other times the ripe, well-colored fruits are preferred, especially in the smaller markets. It is fortunate that the fruits do not deteriorate rapidly after they have attained full size.

The well-ripened specimens are so handsome that they offer special inducements for fancy methods of marketing. Small, white baskets, lined with colored tissue paper, may be used to advantage and, if desired, each specimen may be wrapped in very thin transparent paper.

1. When should peppers be picked? W-VG : 416.
2. What packages are desirable for marketing peppers?
3. Explain the packing of peppers for market.
4. *What is a good yield of peppers to the acre?*
5. *How are peppers utilized and served on the table?*

CHAPTER THREE

COLE CROP PROJECTS

Cabbage, Cauliflower, Brussels Sprouts, Collard, Broccoli

The cole crops, named above, are classed as hardy vegetables because they are not injured by frost. Well-hardened plants stand considerable freezing. They grow best in a cool, humid climate and in moist, fertile soils.

Cabbage and cauliflower are treated in separate projects. Brussels sprouts may be of sufficient importance in some localities to justify their selection for a home project. In this event, Project IV, Growing Cabbage, will be found helpful and might be followed in most of the details of culture. More specific information relating to the culture of this crop will be found in W-VG : 253-254, L : 130, C : 159-161, A : 86-89.

The collard and broccoli are of little importance. They are discussed briefly in W-VG, L, C, and A.

Project IV. Growing Cabbage

The cabbages belong to the mustard family, a large group with about 2000 species. In this family belong also other crop plants, such as cauliflower, broccoli, brussels sprouts, collard, turnip, radish, white mustard, etc. The members of the mustard family are widely distributed over the world in both southern and northern countries and both low and high altitudes. The wild form, which is supposed to have given rise to the cultivated varieties of cabbage, is a native of Europe. By modifications of the leaves and buds, ordinary cabbage and brussels sprouts have been de-

veloped; by modifications of the flower clusters cauliflower and broccoli have been produced. All of these plants are regarded as different varieties of a single species.

Common head cabbage is in reality a huge terminal bud in which large thick leaves overlap to form the bud. The central stem is short. This is the only growth produced the first year. The root is a typical tap root, solid and more or less woody. Elongated clusters of yellow flowers are produced the second season. The seeds are produced in elongated pods.

There are several types of common cabbage, based upon color, size, shape of head, character of leaves, and time of maturing.

1. To what family does the cabbage belong and what are some of its near relatives?
2. What sort of structure is a cabbage head?
3. What kind of root system does cabbage have?
4. When are the seeds produced?

Project Outline

1. Why grow cabbage?
2. Selecting location.
3. Choosing varieties.
4. Obtaining seed.
5. Constructing the hotbed.
6. Constructing the cold frame.
7. Making plant boxes.
8. Making straw mats.
9. Sowing for the early crop.
10. Caring for the seedlings.
11. Transplanting.

12. Hardening the plants.
13. Growing late plants.
14. Preparing the garden soil.
15. Planting in the garden.
16. Companion cropping.
17. Cultivating.
18. Combating insects and diseases.
19. Harvesting and marketing.
20. Storing the late crop.

1. **Why grow cabbage?** — Cabbage is one of the most important of the vegetable crops. It is seldom omitted in the home garden and enormous quantities are grown for commercial purposes. There are well-known cabbage-growing districts in various parts of the North, and millions of crates of early cabbage are shipped to the North annually from the southern states. It is also one of the leading crops of market gardeners and truckers who are operating near all of our larger centers of population.

1. **Will it pay you to grow cabbage? Early or late?**
2. **Are markets available where you can sell your crop?**
3. **What is the commercial importance of cabbage?** C : 161.
4. **In what parts of the country is early cabbage most largely grown? Late cabbage?**
5. **What is known about the history of cabbage?**
6. **What are its chief botanical characteristics?**

2. **Selecting location.** — Cabbage has been grown successfully on the greatest diversity of soil types. The sandy loams are unquestionably the best adapted to growing an early crop, while the

moist, fertile, heavy loams are preferred for the late crop. There can be no doubt about the necessity of an abundant supply of soil moisture and available plant food. Southern or southeastern slopes possess special advantages for the production of a very early crop.

1. **What kind of soil is best for early cabbage?** For late cabbage?
W-VG : 265. C : 164. A : III-IV. R : 28.
2. **Do you have a suitable location for growing either early or late cabbage? Describe its soil and exposure.**
3. **What is the character of the soils in the most important cabbage-growing districts of the country?**
4. **What is the character of the soil in your neighborhood where cabbage is grown?**

3. Choosing varieties.—There are numerous groups and varieties of cabbage. The student should refer for more detailed information on this subject to W-VG : 255-262. Of the early sorts Jersey Wakefield is the best known and the well-bred strains of this variety possess special merit for the growing of an extremely early product. In recent years, Copenhagen Market is finding favor especially among commercial growers because it is larger than Jersey Wakefield and will stand longer in the field without bursting. It is the leading



FIG. 24.—A typical head of Jersey Wakefield cabbage.

early round-headed variety. Succession, a remarkably good, well-bred mid-season variety, is often sown rather late for the fall crop. Enkhuizen Glory is also a very good round-headed sort that does well for the second and also for the late crop. Danish Ballhead is by far the most important variety for storage and for winter market.

1. What variety would you select for the early and late crop and for storage?
2. What are the merits of the varieties which you have decided to plant?
3. How may varieties of cabbage be classified?
W-VG : 255. L : 119. C : 183.
4. Name and describe the leading varieties, early and late, of the various classes.
W-VG : 255-260. L : 119. C : 183. A : 22-23.
5. What varieties are grown in your neighborhood?

4. **Obtaining seed.** — Cabbage seed should be purchased with the utmost care, in order that the least possible risk may be taken of getting a poor strain. You should also buy the seed early and make a germination test before it is time to start the crop. Growers should make thorough inquiry about the best sources of seed of the varieties wanted.

1. What precautions should be taken in the purchase of seed?
2. How much seed will you need? W-VG : 495.
3. Where can good seed of the varieties desired be bought?
Consult local growers, seed catalogues, and the reports of vegetable growers' associations.

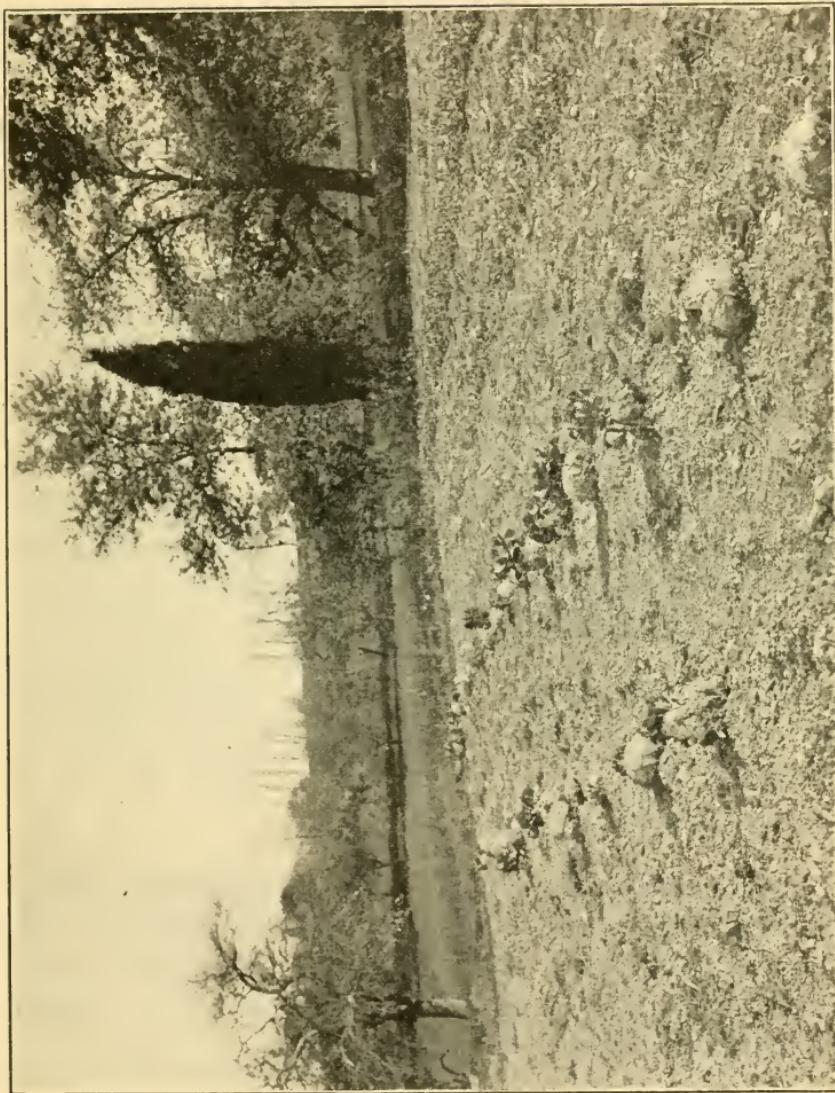


FIG 25.—Cabbage plants with well-developed heads planted early in the spring for a seed crop.

4. *Do you advise the home growing of seed? If so, how is it done?*
5. *Where is most of our cabbage seed grown?*
6. *How many years will cabbage seed retain its vitality?*
7. *Is it desirable to buy cabbage seed a year in advance, and test it by growing a small plot before making an extensive plantation?*

5. Constructing the hotbed. — Unless the seed is sown in a greenhouse or the kitchen window, a hotbed will be needed to start the early plants. Instructions for the making of hotbeds are given in W: 44-45.

See W: 44-46 references and questions.

6. Constructing the cold frame. — Cold frames are practically indispensable in the growing of good early cabbage plants. Instructions for making them are given in W: 46-47.

See W: 46-48 references and questions.

7. Making plant boxes. — Thousands of growers start their early cabbage plants in flats or plant boxes. They have many advantages. Explanations for making them are given in W: 48-49.

See W: 48-50 references and questions.

8. Making straw mats. — Plants even as hardy as the cabbage may be killed by freezing in either hotbeds or cold frames. The sashes must be covered at night to insure the safety of the plants. Straw mats have been found highly satisfactory for this purpose. Directions for making them are given in W: 50.

See W: 50-51 references and questions.

9. Sowing for the early crop. — In most northern sections, seed for the early crop should be sown about February 1. The

seedlings should be ready to be transplanted in three or four weeks. This will allow six weeks more before they will be wanted for field planting. In the warmer parts of the North, as in New Jersey, the plants may be set with safety in the open ground about April 1.

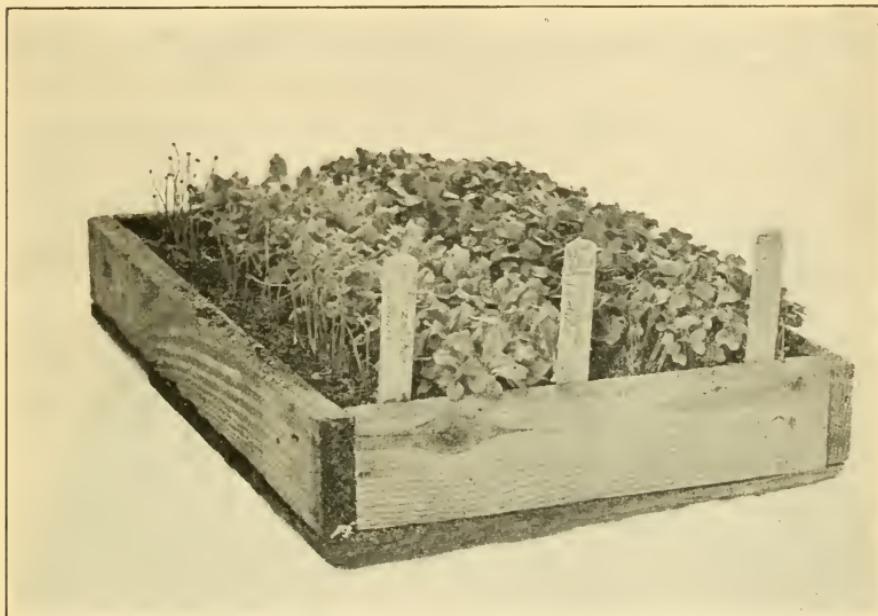


FIG. 26. — Flat of seedlings: onions, lettuce, and cabbage plants.

In this case the seed should be sown January 15. There should be about ten weeks from seed sowing to field planting.

The cabbage requires a lower temperature for starting the plants than the tomato. A day temperature of 60 degrees and 50 or even 45 at night will be found suitable for growing good plants. Further instructions in W: 51 and references will be found applicable to sowing seed for the early crop.

1. See W: 51 references and questions.

2. When should seed be sown for the early crop?

W-VG : 265-266. L: 118.

3. At what temperature should the seed be germinated?

W-VG : 265-266.

4. How many flats must be sown to start enough plants for your project?

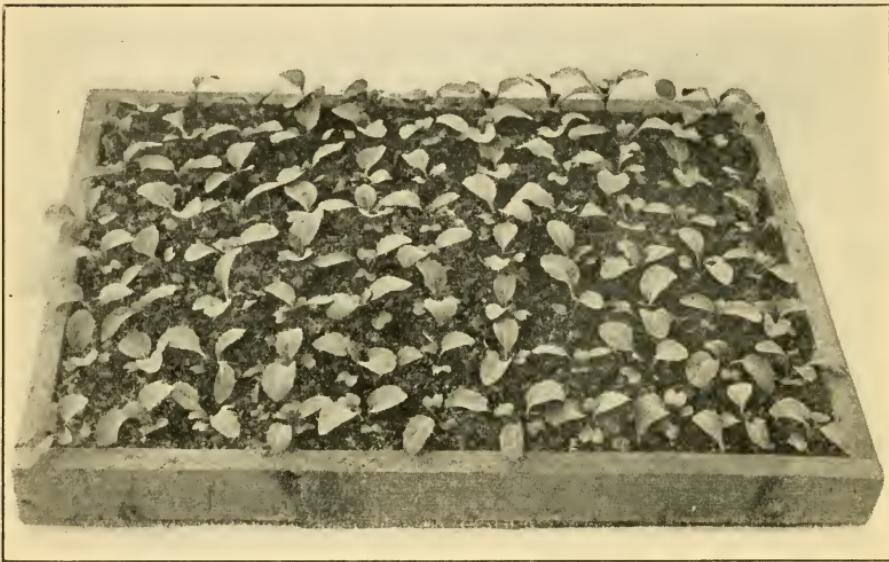


FIG. 27.—A flat of strong, stocky cabbage plants.

10. **Caring for the seedlings.** — It is exceedingly important to avoid overwatering and excessively high temperatures in the growing of early plants. Such conditions are certain to cause weak, spindly plants which are always in danger of being lost by damping-off — a fungus trouble causing the stems to decay near the surface of the ground. The student should consult W: 44 for further information on starting plants in the hotbed.

1. See W: 58 for references.

2. What conditions should be avoided in caring for young plants?
W-VG : 155. C : 12.

11. **Transplanting.** — Early plants should be transplanted in plant boxes and shifted into the cold frame about March 1. It is desirable, if possible, to keep the transplanted seedlings in greenhouse or hotbed temperatures for several days after transplanting to enable them to become rooted before shifting to the cold frame. Seedlings may be transplanted directly into the cold frame in the absence of flats. Warm days must be chosen for this work. Excellent plants may be grown if they are set one and one half inches apart each way, though spacing at two inches will secure stronger ones. The instructions given for transplanting tomatoes (W : 59) from the hotbed apply equally well to cabbage, except that cabbage is rarely transplanted more than once before the plants are taken to the field, and pots are seldom used in starting the plants.

1. See W : 59 and references.
2. When should the early plants be transplanted to the cold frame?
W-VG : 265.
3. How far apart should the plants be set in flats or in the cold frame?
W-VG : 265.
4. How often should the seedlings be transplanted?
5. How much cold frame space or how many flats will be needed for your plants?
6. How would you get rid of rats and mice should they be found in the frames?

12. Hardening the plants. — Too much emphasis cannot be placed on the importance of thoroughly hardening the plants. When well hardened they generally have a bluish-red tint, and they may then be transferred to the field. If strong, vigorous, and well hardened, they will stand a temperature of 10 to 15 degrees below freezing, but otherwise they may succumb to light freezing. The neglect of this simple operation may cause the total loss of the plants. Hardening is accomplished during the last ten days to two weeks before the plants are set in the open ground, by watering sparingly or scarcely at all, just enough to keep the plants from wilting, by gradually subjecting them to low temperature, and finally, by giving them no protection day or night in the cold frame.

1. See W : 63 and references and questions.
2. What is the importance of hardening early cabbage plants?
W-VG : 159.
3. Explain how you would proceed to harden the plants.
4. How long does it take?

13. Growing late plants. — Late plants are nearly always started from sowings made in the open ground. The time of sowing depends upon the climate and the varieties to be grown. In most northern localities the seed is sown during the month of May. Very late varieties, like the Danish Ballhead, should be given the advantage of early sowing, while the mid-season ones, such as Succession, need not be sown until several weeks later. The tendency, however, is to err in sowing too late. The chances for a good crop are better from fairly early sowing and timely transplanting into the field.

A fine, moist seed bed should be prepared where neither cab-

bage nor any other cruciferous crop has been grown for at least four or five years. This is important from the standpoint of avoiding clubroot and other diseases of this group of plants. The drills should be made a foot apart, to permit of wheel-hoe tillage, eight to ten seeds dropped to the inch of furrow and covered with about one half inch of soil. Firming the soil after the seed has been sown will insure more prompt germination.

1. When should seed be sown for the late crop in your locality?
W-VG : 267. L : 124. R : 20.
2. When and how should the seed bed be prepared?
W-VG : 267. L : 124. R : 20.
3. How should the seed be sown?
W-VG : 267. L : 124. R : 20.
4. How much seed will you need? How large a seed bed will be required?

14. Preparing the soil.—The cabbage requires high fertility. In thin soils the heads either fail to mature or are small and soft. The plants thrive in moist soils abounding in available plant food and organic matter. Heavy clover sods provide ideal soil conditions for cabbage. If clover or grass sods are not available, then stable manure should be used more liberally. Any kind of manure, old or fresh, may be used to advantage for cabbage. The amount that should be applied will depend on whether a sod is to be used and also on the fertilizer application. If half a ton or more of a high-grade fertilizer is used with a heavy clover sod, stable manure might be entirely omitted. Most excellent crops of cabbage are grown on good soils without any stable manure. With sod on moderately fertile land, ten tons of stable manure, and at least half a ton of commercial fertilizer to the acre, should give good

results. Growers often use a ton of commercial fertilizer to the acre. It should contain a liberal proportion of phosphoric acid, also nitrogen, if this element can be bought at a reasonable price. Potash should probably be used on most soils, but its application does not seem to be so important as the other materials mentioned.

The most dreaded and destructive disease of cabbage is clubroot, caused by a slime mold. Regular and heavy liming seems to be the most effective preventive measure that can be taken against losses from this enemy. At least two tons of caustic lime to the acre should be employed, and the crop should not be grown on the same land at closer intervals than four or five years. Apply three or four tons in case of clubroot.

It is nearly always an advantage to plow the land in the fall for the early crop and in early spring for the late crop.

1. See W:63 and references.
2. What are the plant food requirements of cabbage?
3. What crops might precede cabbage? W-VG:268.
4. Should stable manure be applied? If so, what kind, how much, and when? W-VG:269. C:165.
5. Should commercial fertilizers be applied? If so, what kind and how much? W-VG:269. C:165. R:36-40.
6. Determine the best treatment for the flat that you will use for cabbage.
7. What are the values of lime for growing cabbage? The general functions of lime in the soil?
8. When should you plow for early cabbage? For late cabbage?

9. Estimate the requirements of lime, fertilizer, and manure for your cabbage project.
10. *What are the various sources of lime, phosphorus, nitrogen, and potassium?*
11. *What are the best directions for mixing a suitable fertilizer for cabbage?*

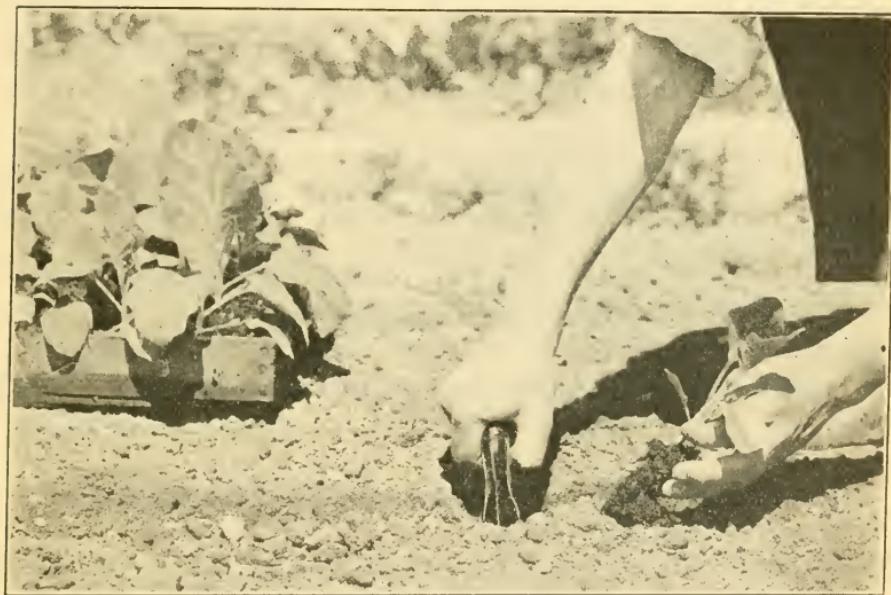


FIG. 28.—Transplanting cabbage plants in the field by the use of a dibber.

15. **Planting in the garden.**—In most sections of the North, strong, well-hardened early plants may be set in the garden or field as soon as the ground can be prepared. As a rule, we can begin transplanting out of doors about April 15, and earlier in some sections. Late cabbage is ordinarily transplanted between June 15 and July 10. Experience has taught commercial growers that comparatively early planting, say from the fifteenth to twen-

tieth of June, for late varieties is more likely to result in a good yield than later transplanting.

When tillage with a horse is contemplated, 28 inches between rows, even for the earliest varieties, is as close as you should plant, and most growers allow two to eight inches more space. Liberal spacing is favorable to growing of large heads.

The spacing between plants in the rows will depend mainly on the variety used. The small, early varieties with pointed heads, such as Jersey Wakefield, may be set as close as 14 inches apart; mid-season flat varieties, as Succession, 18 inches; while the larger, later varieties should have 20 to 24 inches between plants in the rows.

Cabbage plants are often set in the field with transplanting machines, but hand planting, as explained in W : 59 for tomatoes, is the usual plan.

1. See W : 59 and references and questions.
2. When should early cabbage plants be set in the open ground ?
W-VG : 272. L : 118.
3. When should late cabbage plants be set in the field ?
W-VG : 272. R : 46.
4. What are the proper planting distances for the most important early and late varieties ?
5. What are the best rules for marking the ground and setting the plants ?
16. **Companion cropping.** — Early cabbage is unusually well adapted to companion cropping. Numerous combinations including the cabbage are in common use. Cabbage, lettuce, and radishes are often started together at the same time. A row of

lettuce may be set between two rows of cabbage and, if the spacing is ample, radishes may be sown between rows and even between plants in the rows. The radishes mature and are harvested first, then the lettuce grown from transplanted plants, and finally all of the ground is devoted to the cabbage crop. It is unlikely that these crops seriously interfere with each other, though they make tillage more tedious, but they greatly increase the producing power of the area under cultivation. The cabbage may be harvested in time to follow with a crop of beans or perhaps a green manurial crop, such as vetch or crimson clover, that may be plowed down the following spring for tomatoes and other vegetables.

1. *Describe several systems of combination cropping which include cabbage.* W-VG : 477-478, 480, 486, 488.

17. Cultivating. — Both the early and the late crop should have frequent and thorough tillage. When the plants are well grown, fewer leaves will be broken off if the cultivating is done in the middle of the day when the leaves are limp or less rigid than in the morning or evening.

1. **See W : 99 and references.**
2. **What recommendations do you make for the cultivation of cabbage?** W-VG : 273.

18. Combating insects and diseases. — Among the cruciferous plants, cabbage and cauliflower are probably more seriously injured than other cole crops by species of insects common to the entire group. Attacks by the insects are usually coincident with the appearance of the first leaves in the seed bed and continue throughout the growing season.

The wilting of early cabbage plants in the field or late plants in seed beds is a good indication of an attack by root maggot.

Such plants when pulled have only a tap root devoid of the usual fibrous growth. The injury may be accompanied with more

or less decay of the tissues where older maggots have tunneled the root.

The parent is a two-winged fly which deposits eggs on the ground close to the stem along which the newly hatched maggots work their way to the more tender roots. Two to four generations may occur annually, and, in the fall, eggs, larvæ, and adults



FIG. 29.—Wilting due to cabbage maggot.

may be found in the old cabbage stumps.

Control: Tar paper disks placed around plants at setting have proved valuable protectors. (CL: 33.) Crude carbolic acid emulsion is said to reduce maggot injury where early plants have not been protected. (CL: 33.) Protection for late cabbage can be provided by screening the seed bed with cheesecloth. (CL: 35.)

Imported cabbage worm: The familiar white butterfly with fore wings grayish tipped is the parent of our common green cabbage worm. The caterpillar, a velvety green "worm," is distinguished from closely related forms by a faint yellow line along the middle of its back.

The caterpillar eats large irregular holes in the leaves, often leaving nothing but the larger veins.

The adult deposits yellow, delicately ridged eggs on the under

surface of the leaf, and from these hatch small, green caterpillars that immediately begin skeletonizing the leaf. In ten to fourteen



FIG. 30.—Cabbage worm.

days they become full grown and fasten themselves to the under side of the leaf or other protected surface and change to a pupa from which in about a week the butterfly emerges. Several broods develop in a season.

This pest is controlled by hand picking or dusting when only a few plants are grown. Poison sprays applied as soon as young caterpillars appear are the best for large plantings.

1. *What indicates maggot injury to cabbage?* CL : 29-36.
2. *What is the life history of the maggot?* CL : 29-30.
3. *Is clean farming a desirable practice? If so, why?* CL : 32.
4. *State briefly three methods of preventing injury by the maggot, indicating when each is most desirable.* CL : 33-36.

5. *Name some other maggots that affect cabbage.*
CL:36. CL:37-38.
6. *How does the imported cabbage worm adult differ from the other common cabbage butterflies?* CL:6-8.
7. *Can the caterpillar be easily distinguished?* CL:5-8.
8. *Describe briefly the life history of the imported cabbage worm.*
CL:4-5.
9. *Does it injure the outer leaves only?* CL:5.
10. *What is the best spray to use?* CL:6.
11. *What other common cabbage worms affect this crop?* CL:7-21.

Black rot causes enormous losses to cruciferous crops both

in the field and in storage. This is a bacterial disease and is first noticeable in the field by a blackening of the veins near the edges of the leaves. Such leaves soon become yellow and die. If infected plants are stored, the disease continues to develop in storage. The black rot bacteria live in the soil and may be spread upon the seed or on plants shipped from one place to another. They may also be spread from field to field on tools and in manure. Control measures involve first of

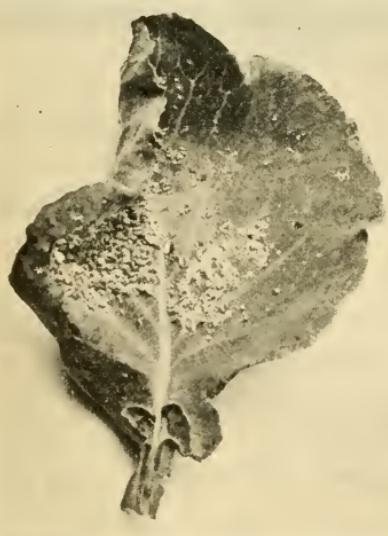


FIG. 31.—Aphis-infested cabbage leaf.

all crop rotation. Cabbage should not be planted for several successive years on soil which has produced cabbage with black

rot. Cabbage seed should be soaked from ten to twenty minutes in formaldehyde (one teaspoonful to a pint of water).

Club root attacks the roots and stems, causing them to become swollen and enlarged. Often infected plants remain stunted and do not produce heads. The organism causing club root lives in the soil and is spread by wind, in manure, on seedling plants, weeds, and tillage tools. Club root may be controlled by liming the soil. Slaked lime should be applied in the fall at the rate of about seventy-five bushels per acre and should be well worked into the soil. Crop rotation should be practiced, allowing cabbage to be grown on the same soil only once in about five years. Varieties Hollander, Stone, Mason, and Henderson's Early Summer are somewhat resistant.

Yellows or wilt is a disease characterized by yellowing and dropping of the leaves. Plants often die. Control is similar to that described for black rot. The variety Wisconsin Hollander is resistant.

Other diseases of cabbage of less importance are black leg, downy mildew, and soft rot.

1. What are the symptoms of black rot of cabbage?

SH: 165-166.

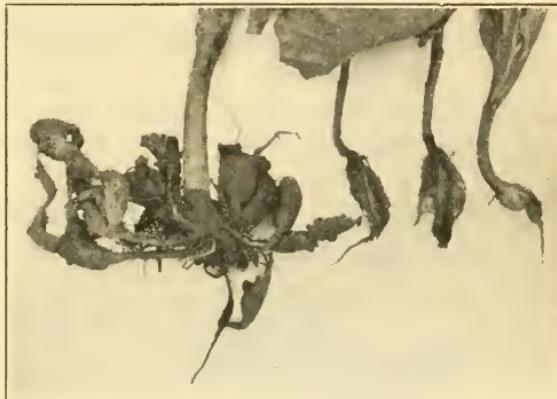


FIG. 32.—Club root is the most serious disease of cabbage and related crops.

2. What is the cause of the disease and how does it spread?
SH: 166-167.

3. What control measures are recommended for black rot?
SH: 167-168.

4. How does club root affect cabbage plants?
SH: 168-169.

5. How may club root be kept under control?

19. Harvesting and marketing.—Cabbages should seldom be harvested until the heads are solid and mature. The crop is

usually cut with a strong, sharp butcher knife. If to be buried or stored with most of outside leaves remaining, a sharp hatchet will be found convenient, when a stub of the stem four or five inches long should be left, which will serve as a very useful handle.



FIG. 33.—Brussels sprouts; the lower leaves have been removed to induce the formation of large buds commonly called "sprouts."

Most markets demand fairly close trimming. The crop is usually packed in baskets or crates for shipment and sold by count or by weight on local markets.

Yields vary from ten to twenty or more tons to the acre, and there is the widest range in prices.

1. When should early and late cabbage be harvested?
W-VG: 273. C: 166. R: 87.

2. How much freezing will mature cabbage stand?
3. What is the most convenient method of harvesting?

W-VG : 274. C : 166. R : 88-92.

4. How should cabbage be trimmed for market?

5. How would you pack it for market?

W-VG : 274, 162-187. C : 166.

6. Will it sell best on your market by the crate, barrel, bushel, weight, or by the head?

7. How is cabbage shipped to your market?

8. What prices does it command?

9. What is a good yield of cabbage to the acre?

10. When does it pay to make sauerkraut? How is it made?

20. Storing the late crop. — There are so many methods of storing late cabbage that little attempt will be made here to describe them, but the student should consult the references. No other plan will keep winter cabbages in better condition than burying. This should be done as late as possible in the fall. A well-drained location should be selected, and the heads should be covered



FIG. 34.—Good head of Pe Tsai or Chinese cabbage. This is becoming more popular among American gardeners every year.

with at least four or five inches of soil. An additional covering of five or six inches of horse manure will give ample protection to the heads in most parts of the North, though more manure should be used in the coldest sections.

1. What is the best method for you to store your cabbage?
2. Do you think it will pay you to store cabbage? Why?
3. Describe the most important methods of storing cabbage.
4. How may it be buried successfully? W-VG : 280-281. L : 308-309.

Project V. Growing Cauliflower

Cauliflower and broccoli belong to the mustard family. They are close relatives of common cabbage but differ from it very

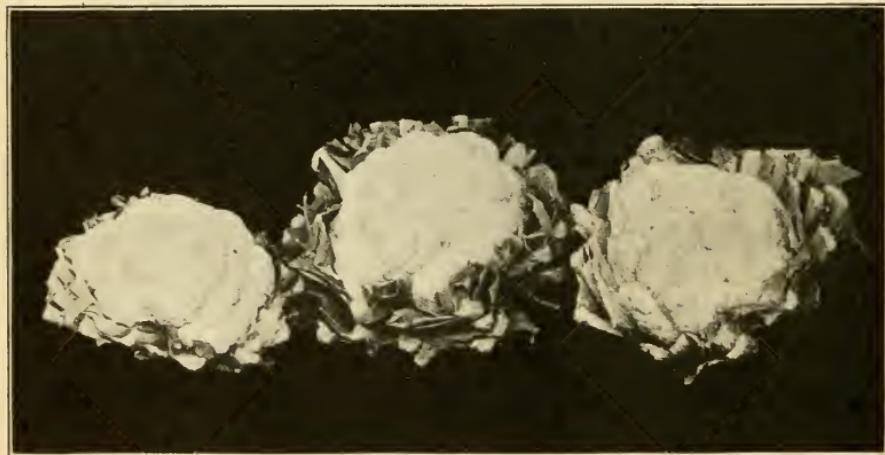


FIG. 35.—Good heads of Snowball cauliflower.

greatly in the structure of the head. In cabbage the head is an enlarged bud composed only of leaves. In cauliflower and broccoli the head is made up of modified, thickened flower clusters

surrounded by a number of green, cabbage-like leaves. The edible part is entirely the modified floral parts. In order to grow seed the plants are started in July and when partly developed are stored in cold frames for the winter. The following season they are set in the open ground again and will produce seed. The plants grow best and the seeds mature well only during comparatively cool weather. Seed is not successfully produced in this country except in the northern Pacific Coast region where the climatic conditions seem most favorable, and to a limited extent in greenhouses.

Cauliflower and broccoli are very similar. Broccoli differs in having smaller heads surrounded by more numerous stiffer leaves and in requiring a longer time to mature.

1. *What is the nature of the head of the cauliflower?*
2. *When will cauliflower produce seed?*
3. *How is broccoli related to cauliflower?*

Project Outline

1. Importance of crop.
2. Selecting location.
3. Choosing varieties.
4. Obtaining seed.
5. Starting plants.
6. Preparing soil.
7. Planting in the garden.
8. Companion cropping.
9. Cultivating.
10. Protecting heads.
11. Combating insects and diseases.
12. Harvesting and marketing.

1. Importance of crop. — Cauliflower is regarded as the most refined and the most delicate member of the cabbage family. It is unquestionably the most difficult to grow. The crop is of special commercial importance in certain localities that furnish ideal climatic and cultural conditions such as Long Island and other sections adjacent to large bodies of water. It is grown locally to a greater or less extent for all northern markets, and it is a favorite crop with thousands of home gardeners.

- 1. To what extent is cauliflower grown for commercial purposes?**
W-VG : 295. C : 187.

- 2. What points can be made in its favor for the home garden?**
W-VG : 295. C : 187.

- 3. Do you think you should grow cauliflower as a home project?**

- 4. What is known about the history of cauliflower?**

- 5. How does cauliflower differ botanically from cabbage?**

- 6. Carefully examine and describe a head of cauliflower. Of what parts of the plant is it composed?**

- 7. What are the best methods to cook and serve cauliflower?**

- 8. To what extent is cauliflower grown as a forcing crop?**

2. Selecting location. — Though cauliflower is very closely related to cabbage, conditions which are favorable to the culture of the latter crop might fail to yield a satisfactory crop of cauliflower. For example, farm land of average fertility with a fairly heavy grass sod, and moderate applications of plant food, should produce a profitable crop of cabbage; but its use for cauliflower, on a business scale at least, would be an unsafe venture. In the

culture of cauliflower, we are dealing with a plant of exacting climatic, soil moisture, and plant food requirements, and these very reasons may commend the crop to students who have had considerable gardening experience. The chances of success will be much greater if we can find a plot of ground which is naturally fertile and moist, though well drained. Proximity to a large body of water is always an advantage for this crop, because it insures high humidity which is favorable both to the growth of the plants and the development of the heads.

1. What are the most important considerations in selecting a location for cauliflower?

W-VG : 297. L: 120. C: 188. A: 69-72.

2. What are the most favorable climatic conditions?

W-VG : 297. L: 120.

3. Have you a suitable location for this crop?

4. In what parts of the country is cauliflower most largely grown?

3. Choosing varieties.—The three leading varieties of early cauliflower are Dwarf Erfurt, Snowball, and Snowstorm.

1. What are the leading early varieties of cauliflower? Late varieties?

W-VG : 298. Seed catalogues.

2. What varieties are grown in your community?

3. What varieties are best for you to grow?

4. Obtaining seed.—The most perfect conditions may be provided for the growing of cauliflower, but poor seed may cause almost a total loss of the crop. It is not so much a question of whether the seed will grow or not, but the great question is, has

the seed been well bred so that it will produce a good crop under favorable conditions? Enough has been said to show the student that he should exercise extreme care in purchasing cauliflower seed. Consult market gardeners in the community; get in touch with your county agent; write your agricultural college. Make certain, if possible, that the seed you plant will not disappoint you by yielding a light and poor crop.

1. What is the result when poor seed is planted?
2. What has the U. S. Government done in growing seed under glass?
W-VF: 236.
3. Where can you get good seed?
4. How much seed will you need?

5. **Starting plants.** — Greater care must be exercised in the growing of cauliflower plants than in starting early cabbage plants. The seedlings are more susceptible to damping-off fungi, and are more sensitive to variable temperatures and soil moisture conditions. While there should be a constant supply of soil moisture to the full depth of the plant bed, overwatering must be avoided. In brief, extreme care must be exercised to be successful in growing early cauliflower plants. In general, they are grown in practically the same way as early cabbage plants, though the seed is seldom sown in the North very much before March 1, and the plants should not be subjected to such low temperatures.

Late plants are started from field sown seed as explained for growing late cabbage plants.

1. Describe in detail the growing of early cauliflower plants.
W: 44-65, 94-99. W-VG: 298. C: 188.

2. How are late cauliflower plants started?

W-VG : 299. C : 189.

6. Preparing soil. — In W:114 the importance of a moist, fertile soil was strongly emphasized. No effort should be spared in the preliminary tillage operations, and rotten manure should be used in liberal amounts. It is likely that a ton of high-grade fertilizer to the acre may be profitably applied. Lime is usually desirable.

1. Describe the preliminary tillage operations for planting cauliflower.**2. How should cauliflower be fertilized?**

W: 99. W-VG : 299. C : 188.

7. Planting in the garden. — The early plants should not be set in the open ground until after danger of hard frosts is past. While frost will not kill well-hardened plants, it is unsafe to proceed very far in the hardening of cauliflower plants, for this may check their normal growth and development, and interfere with head formation. Late plants are generally transplanted about the first of July.

1. When should early cauliflower plants be set in the open ground?**Late plants?**

W-VG : 299. CL : 189.

2. What should be the planting distances for early and late cauliflower?

W-VG : 299. W : 313. CL : 189.

3. Under what conditions does cauliflower head the best?

8. Companion cropping. — Cauliflower may be used as a companion crop with other vegetables very much in the same way as

cabbage. However, companion cropping out of doors is not so popular as under glass, where space is more valuable.

1. *Suggest a few good plans for companion cropping, including cauliflower.*

W : 102. W-VF : 384.

9. Cultivating. — The most thorough cultivation should be given this crop, beginning immediately after planting in the field. Small areas are often planted close together and cultivated with a wheel hoe. W : 305.

10. Protecting heads. — Whether the cauliflower is to be sold or used on the home table, the heads should be pure white. To accomplish this it is necessary to protect them from the rain and sunshine by tying the leaves together over the heads or by fastening them in some other convenient manner. This operation should have attention as soon as the heads are visible or when about an inch in diameter.

1. **Why should heads of cauliflower be protected?**

W-VG : 300. L : 122.

2. **When should it be done?**

W-VG : 300. C : 189.

3. **What plan will you employ to protect the heads?**

W-VG : 300. C : 189.

11. Combating insects and diseases. — The various enemies of cabbage also feed on cauliflower.

12. Harvesting and marketing. — Cauliflower is so delicate and tender that the heads are easily bruised by any rough handling. Though commercial growers often pack in barrels and crates, the less extensive grower will find that his profits may be increased

by wrapping the heads in tissue or light oiled paper, either white or of a greenish tint. If proper care is exercised in marketing, a paying price should be received for every head.

1. When should cauliflower be cut and how should it be prepared for market?

W-VG : 300. C : 190-192.

2. What kind of package will be best for your market?

W-VG : 300. C : 191.

3. What is the usual price paid for cauliflower by your local market?

CHAPTER FOUR

SALAD CROP PROJECTS

Celery, Lettuce, Parsley, Endive, Corn Salad, Cress

Though a few other vegetables of minor importance may be included in the list of salad crops, the ones of main importance are celery, lettuce, parsley, endive, corn salad, and cress. Celery and lettuce are produced largely for the home table and for commercial purposes in most parts of the country, and they are treated as separate projects. Parsley is a species belonging to the carrot family. It is a close relative of celery. Parsley behaves as a biennial, growing a group of leaves the first season and sending up an erect flowering stalk the second season. The leaves are much cut and often curled in garden varieties. The flowers are greenish-yellow. Parsley is a native of the Old World and is grown to some extent in American gardens, but is not considered a crop of great financial possibilities largely because of the limited demand for it. Instructions relating to its culture may be found in W-VG: 406; L: 157, 158, 310; C: 327. Endive, cress, and corn salad are of less importance than parsley. Brief references to their production may be found in W-VG, L, and C.

The salad crops are comparatively shallow rooted. They require an abundance of plant food and a constant supply of soil moisture.

Project VI. Growing Celery

Celery belongs to the carrot family which includes also the parsnip and parsley. This family is most at home in the north

temperate region. The wild form, from which our cultivated celery has arisen, is a native of Europe.

In common celery the portions of the plant which are used commercially are the enlarged leaf stalks, botanically known as the petioles. In celeriac, or turnip-rooted celery, the root is enlarged and fleshy and constitutes the edible portion of the plant. Celery and celeriac are offshoots of the same species. Ordinarily celery grown from seeds forms a clump of leaves, with the thick stalks the first season, and if left in the ground sends up seed stalks the second season. A plant thus producing seed the second season is known as a biennial. The flowers are white, small, and in small groups called umbels. The seeds are small, it being estimated that an ounce contains between 60,000 and 70,000 seeds. The leaves are compound, and the leaflets divided and coarsely toothed. The white or blanched condition of the leaf stalks is secured by keeping the light away from them. The green color, which is such a predominant feature of plants, can develop only in the light. Potato sprouts growing in a dark cellar, or grasses growing under a board, are without green color. In order that growth may continue the green color must be developed somewhere. Therefore in celery growing the leaf stalks are kept from the light, but the leaf blades are left in the light.

1. *To what family does celery belong?*
2. *How does celery differ from celeriac?*
3. *Why is celery said to be a biennial?*
4. *Under what conditions does the blanching of celery take place?*

Project Outline

1. Why grow celery?
2. Selecting location.

3. Choosing varieties.
4. Obtaining seed.
5. Constructing the hotbed.
6. Constructing the cold frame.
7. Making plant boxes.
8. Making straw mats.
9. Sowing for the early crop.
10. Caring for the seedlings.
11. Growing late plants.
12. Preparing the soil.
13. Planting in the garden.
14. Companion cropping.
15. Irrigating.
16. Cultivating.
17. Mulching.
18. Blanching.
19. Combating insects and diseases.
20. Harvesting and marketing.
21. Storing the late crop.

1. Why grow celery? — The student gardener will do well to investigate the available markets and ascertain the demand for this vegetable. He may be surprised to learn that they are poorly supplied with good celery and that he has a real business opportunity to engage in the growing of a crop the production of which is not generally understood. While there are hundreds of successful growers, the fact is that a large percentage of those who attempt the culture of this salad crop do not achieve as great success as they do with many other vegetables, such as the onion, cabbage, tomato, sweet corn, and potato — vegetables which are more universally grown. It must be admitted that celery is more difficult to grow than the vegetables just mentioned, but this very fact may make its culture a more attractive business venture to

the ambitious student or club member. At the same time, let us remember that there is nothing mysterious about the growing of celery, that it is largely a matter of understanding the principles involved and of adopting practices that conform to the principles.

It is surprising how rapidly this vegetable has gained in popularity among all classes of American consumers. Nearly all home gardeners try to grow a little celery. Thousands of general market gardeners grow the crop, and it is produced on a mammoth scale by specialists who cultivate muck soils. There is a peculiar fascination in growing the crop because of the skill required and because of the splendid earning capacity of the plot of ground when properly managed.

1. Is your market well supplied with good celery?
2. Do you think the crop offers special opportunities for you? If so, why?
3. What is the commercial importance of celery?
W-VG : 302. L : 133. C : 194. B : 2.
4. In what parts of the country is celery largely grown for commercial purposes?
B : 2. W-VG : 303.
5. What is known about the history of celery? W-VG : 302.
6. What are its chief botanical characteristics?
W-VG : 303. C : 194. B : 1. W : 119.
7. How is it generally served on the table? W-VG : 302.
8. What is its chemical composition? Its food value?

2. **Selecting location.** — The cooler climates are most suitable for the growing of celery. When its culture is attempted in the

South, advantage is taken of the months that afford the best temperature conditions. While celery is matured at midsummer in the North, our best product does not reach the market until late in the fall. The cool nights of late September and October are most favorable to the development of crisp, tender stalks. It may be said, however, that with intelligent management the crop may be grown with entire success in all parts of the North.

The bulk of the enormous quantity of celery shipped to our great city markets is grown on muck soils. These soils furnish ideal conditions for the crop. They generally contain more than 50% of organic matter and this is the chief reason for their adaptation to celery. They are moist, loose, and fertile, and provide the very best conditions for this shallow-rooted crop.

But comparatively few students or club members can select muck soils for their home project. If the cultivation of this crop is to be attempted, some other soil must be chosen. We must find or make a soil which is loose and friable in its physical properties, and which contains an abundant and constant supply of moisture and available plant food. If we will keep in mind the composition of muck soils (W-VG : 306), it will help us to choose a good soil for celery, though muck may not be available. The sandy loams are excellent. They should abound in humus or decaying vegetable matter. However, any good soil which has been used for gardening purposes should be suitable, with proper treatment, for the growing of celery. It is important, of course, to give very careful attention to the preparation of the soil, especially if it is not naturally ideal for growing celery.

1. What are the most suitable climatic conditions for growing celery? W-VG : 305. L : 133. B : 3.

2. What are the best soil conditions for this crop?

W-VG : 305-308. L : 133. C : 195. B : 4.

3. Do you have a favorable location for celery culture?
4. Describe the climate of the most important celery growing districts.
5. What is the range in temperature, covering a period of ten years, in your own community?
6. What is the composition of a typical muck soil? W-VG : 306.
7. What are the type and composition of the soil you are considering?
8. What is the average annual rainfall of your section?

3. Choosing varieties.—Celery is divided into two general classes, namely, green varieties and the so-called self-blanching types. Probably nine tenths of all the celery sold in the United States belongs to the self-blanching type. This is due to the fact that the plants are generally more dwarf in habit of growth, are more easily blanched, and may be grown closer together than the tall green sorts. In other words, in the judgment of most growers, they offer greater financial possibilities than do the green varieties. On the other hand, we should not lose sight of the fact that the green kinds are superior in quality, and this may be an important consideration in favor of their selection. The self-blanching varieties are invariably selected for the early crop, and they are most



FIG. 36.—Winter Queen celery, one of the best late green varieties.

largely grown on muck soils for the late crops. The green sorts are grown mainly for local markets and for late fall and winter consumption, especially for markets demanding the highest quality.

Golden Self-Blanching is the most extensively grown of this class. The plants are very stocky and compact. White Plume is taller and more vigorous but not quite so good in quality as Golden Self-Blanching. In recent years, Easy Blanching has been introduced, and it is rapidly gaining friends because of its vigor of growth and superior quality.

Among the green varieties, Giant Pascal has stood at the top of the list for high quality. Winter Queen, French's Success, and Boston Market are also favorite varieties.

1. What varieties would you select for an early crop? For a late crop?

W-VG : 304-305. B : 125-129. Catalogues.

2. What are the merits of the varieties which you have decided to plant?

3. How may varieties of celery be classified? B : 125.

4. What varieties of celery are grown in your neighborhood?

5. How do varieties differ in habit of growth?

4. **Obtaining seed.** — It is urged that the greatest care be exercised in the selection of seed, for inferior seed may cause almost a total failure, regardless of other important factors. Poor seed may result in an inferior type of plants, pithy or hollow stalks, lack of vigor, low percentage of germination or running to seed the first year. We cannot be too careful in this matter. Consult the commercial growers in the neighborhood.

Inquire of reputable seedsmen about the merits of their seed. Write to your agricultural college. Commercial growers often buy seed and test it a year in advance by making small plantings.

1. What are the effects of poor seed? W-VG : 307.
2. Where can you obtain seed of high quality?
3. Where is celery seed grown most largely for the trade?
W-VG : 307.
4. Should you attempt to grow your own seed? C : 195.
5. How would you proceed to grow seed?
6. Should seed be fresh, or a year or more old? W-VG : 307. C : 195.
7. How and where should celery seed be stored? W-VG : 307.
8. How is celery seed used in cookery? W-VG : 302.

5. Constructing the hotbed. — The growing of an early crop will require the construction of a hotbed, unless the plants are started in a greenhouse or in a sunny window. If the student has selected tomatoes, too, for a home project, there is no reason why the same hotbed will not serve for the starting of both crops, for the seed may be sown at the same time. Instructions for the making of hotbeds are given in W : 44.

6. Constructing the cold frame. — It is questionable to what extent cold frames may be used for the starting of early celery plants. The plants must not be subjected to low temperatures at any time, for this may cause them to produce seeds instead of a marketable crop. For this reason, it is better to keep the plants in the warm temperature of the hotbed or the greenhouse until they are transferred to the open ground. However, if the seed

is sown quite late, cold frames may be used for a short period before the plants are taken to the field. For instructions on building a cold frame see W: 46.

7. Making plant boxes. — Plant boxes or flats will be found very convenient for starting early plants. Instructions for making them are given in W: 48.

8. Making straw mats. — Both the hotbeds and cold frames will need protection in addition to that furnished by the sash. Straw mats are very satisfactory for this purpose, and instructions for making them are given in W: 50.

9. Sowing the early crop. — In most parts of the North, seed for the early crop should be sown about March 1. If suitable facilities are available, there is no objection to sowing ten to fifteen days earlier.

Celery seeds are very small and slow to germinate, and for this reason the soil in which they are sown should be fine and friable, so that each seed will be surrounded by the finest soil particles. These soil particles, too, must be kept constantly moist in order to insure prompt germination.

As previously stated, flats are very convenient for the starting of early plants. After filling them with fine soil the seeds are sown thinly in rows about two inches apart and barely covered with fine soil or sand. It is so easy to wash out the little seeds when watering that a good plan is to place a piece of burlap over the box after it is sown and sprinkle this instead of the soil. If desired the burlap may remain on the box until the seeds begin to sprout. Whatever plan is followed, the boxes should be inspected daily and watered as often as may be necessary to keep the soil constantly and uniformly moist, but never wet. A temperature of 70 to 75 degrees should be maintained if possible until the plants are up.

1. How much seed will you need to start your early plants?
When will you sow? W-VG:308. B:1.
2. What kind of soil should be selected for the seed bed?
W:122. W-VG:308. L:133. C:195. B:36.
3. Explain the details of sowing.
W-VG:308-309. L:134-135. C:195. B:37.
4. What temperature should be maintained for germinating the seed?
W-VG:308. B:38.
5. Give instructions for watering the seed bed.

10. Caring for the seedlings. — As soon as the tiny plants are up they must have plenty of light, sunshine, and fresh air, otherwise they will become pale, weak, and spindling. The aim should be to grow short, stocky plants, and this will require close attention in watering and ventilating. Just enough water should be applied to maintain a steady growth. It is well to water between rows with a small stream and avoid wetting tops. The seedlings should be transplanted into flats as soon as the true or rough leaves develop, spacing them about $1\frac{1}{2}$ inches apart each way. The plants are then cared for daily, watering or ventilating as may be necessary to encourage a thrifty, vigorous growth.

1. When should the seedlings be transplanted?
W-VG:309. L:134. C:196.
2. How far apart should the plants be set in flats? W-VG:309.
3. What is the main consideration in watering plants and in ventilating the hotbed or cold frame?
4. What precautions should be taken in transferring the plants from the hotbed to the cold frame?

11. Growing late plants — Seed for the late crop is nearly always sown in the open ground, and the time is usually as early in the spring as the ground can be prepared. If the student is not interested in the growing of early celery, he should study W: 127, so that he may become familiar with the principles involved in the germination of the very small seeds. It is more difficult to maintain a constant supply of moisture in the open ground seed bed than in flats kept in the hotbed or greenhouse.

It is absolutely essential to make a perfect seed bed by the application of rotten manure and the most thorough pulverization of the soil. The rows should be about a foot apart and the seed barely covered. Covering the rows with a screen of some kind or perhaps with old carpet or burlap bags will help to retain the moisture. This practice, however, is seldom necessary if the beds have been properly prepared. The bed should be kept thoroughly cultivated until the plants are set where the crop is to mature.

1. Where should late plants be started?

W-VG: 309. L: 134. C: 196. B: 43.

2. Where should the seed be sown?

W-VG: 309. L: 134. C: 196. B: 43.

3. How should the seed bed be prepared?

4. What are safe directions for sowing and caring for the plants?

5. What other method may be employed in growing late celery plants?

6. Do you think it would pay you to grow late plants to sell to your neighbors?

12. Preparing the soil. — The student has learned in W: 122 that celery is exacting in its soil and plant food requirements. We

cannot hope to make a success of this crop unless we provide ideal soil conditions, physically and chemically.

As previously stated a liberal supply of organic matter is of paramount importance. This is usually provided by applying rotten manure in amounts varying from 10 tons to 50 or more tons to the acre. If the manure can be obtained at a reasonable cost, it will pay, in all probability, to use at least 25 tons to the acre and double this amount may be profitable. Much will depend on the organic content of the soil previous to its preparation for celery.

All kinds of stable and poultry manure are used for the growing of celery. Poultry droppings are especially desirable because of their fineness of texture and large nitrogen content. Poultry manure and other kinds of thoroughly decayed animal manures should be applied after the land has been plowed, and mixed well with the soil by means of a disk or cutaway harrow. In small plots where horse-drawn implements cannot be used, spading forks, wheel-hoe cultivators, and hand rakes may be employed for the same purpose. If only coarse or partly decayed manures are available, they should be applied before the land is plowed.

Comparatively few gardeners attempt to grow celery without the use of commercial fertilizers. The amount to the acre varies greatly as does also the kind. A ton to the acre is considered a fair application for celery, though many growers use a ton and a half or even two tons of a fertilizer that contains about 4% of nitrogen and 8 to 10% each of the mineral elements. A good practice is to apply at least a ton of a complete fertilizer before the plants are set out. Then if the plants do not make a satisfactory growth, top-dress the soil with nitrate of soda. Nitrate of soda should not be used until the plants are well established. From 100 to 200 pounds to the acre may be employed at each dressing, and this should be worked into the soil with tillage tools, unless applied immediately before rain.

1. What kind and how much stable manure should be applied for the growing of celery? W-VG:314. C:197. B:20.
2. What kind and how much commercial fertilizer should be applied for the growing of celery? W-VG:311. C:197. B:23.
3. How and when should the manure and fertilizer be applied? W-VG:311. C:197. B:25.
4. Make an estimate of the manure and fertilizer needed for your celery project.
5. Ascertain the methods employed in fertilizing celery in the most important producing districts of the United States.
6. How are muck soils fertilized for celery?

13. Planting in the garden. — In most parts of the North the early plants are not transferred to the open ground before May 10 to 15. When set earlier than this, severe frosts may injure the plants or cause them to produce seed shoots. Good plants set in the field not later than May 15 should be large enough to sell by August 1. Plants for the late crop are generally set in the field the latter part of June and throughout the month of July.

It is always important to manage the soil so that it will be well supplied with moisture at the time of transplanting. Cloudy weather and high humidity are also favorable to successful transplanting, because these conditions reduce the loss of water by transpiration from the leaves, so that the plants do not wilt so much as when there is warm, bright, clear weather.

There is the widest variation in planting distances for celery. When the early crop is to be blanched by the use of boards (W:133) the rows need not be more than eighteen inches apart, though most growers prefer about two feet. This allows ample space for cultivation or for mulching. (W:132.) If the crop is to be blanched

with soil in the field, it is doubtful if the rows should ever be closer than four feet apart and many growers allow five feet, especially for the tall green varieties.

The distance between plants in the rows varies from four to about eight inches. Early varieties are often planted four to five inches apart, while the large green sorts should be spaced not less than six inches apart. There should be ample space for the full development of strong, stocky plants.

1. When is the proper time to plant early celery in the field?

Late celery? W-VG:312. L:134. C:198. B:54.

2. What are the best planting distances for early and late celery?

W-VG:313. C:198-199.

3. How many plants will be required in your celery project?

4. What conditions are most favorable for successful transplanting?

5. What tools will you need for transplanting?

6. What are the most common planting distances among celery growers?

7. What is the relation of mulching and blanching in regard to planting distances?

14. Companion cropping. — Celery and onions may be grown together satisfactorily. The rows of onions should be a foot apart and they should be planted very early in the spring. Every fourth or fifth row of onions is pulled for bunching and celery planted in these rows. This plan of double cropping is excellent for any soil which is suitable for the growing of both onions and celery.

1. What other plans of companion cropping including celery do you recommend? W-VG:481, 482, 485.

15. Irrigating. — In W: 122 it was pointed out that this shallow-rooted plant must have a bountiful and constant supply of soil moisture. For this reason many celery growers have found it profitable to install irrigation systems. Various plans have been employed, but the overhead methods have been most popular. The distributing pipe lines are parallel, generally about fifty feet apart, and supported above ground by wooden or iron posts. Special nozzles are placed four feet apart in the distributing lines, the latter being turned as may be required by means of levers at the end of each line. With proper water pressure it is possible to apply water uniformly over the entire area between the distributing lines. Certain parts of the equipment that are protected by patents, as drilling machines, nozzles, unions, and other special equipment, may be obtained from the manufacturers, but the galvanized pipe may be bought wherever it can be purchased on the best terms. The manufacturers also furnish, free of charge, bulletins giving complete instructions for the installation and operation of the plants. Students who have access to a town or city water supply, and who expect to grow celery for a number of years, may be fully justified in installing the overhead system in at least part of their garden.

1. *What are the main factors in an overhead irrigating plant?*

W-VG : 79-84. Catalogues.

2. *What would it cost you to the acre?* Catalogues.

3. *Do you think it would pay you to install a plant? If so, why?*

16. Cultivating. — The most thorough and careful cultivation should be given celery. Inasmuch as it is a shallow-rooted crop, we must avoid injury of the root by not cultivating very deep after the plants have attained a good growth. It is also important not to throw any soil on the hearts of the young plants, W: 135.

1. What are the most important points to keep in mind when cultivating celery? W:132. W-VG:314. C:199.

17. Mulching. — An increasing practice among growers of celery, especially the early crop, is to mulch the ground with fresh horse manure as soon as possible after the plants have been set in the field. Ordinarily, the rows are two feet apart and the plants five to six inches apart in the row. The fresh horse manure, if heating, should be spread in layers about a foot deep, or in loose piles, until it has cooled off. It should then be spread four or five inches deep between the rows, which will require forty or fifty tons to the acre. Such a heavy mulch of manure will supply fertility to the plants after every rain or application of water, conserve soil moisture more effectively than the most perfect tillage, and practically prevent all weed growth. In brief, it is one of the most certain guarantees against a failure of this profitable garden crop.

1. What are the benefits of mulching celery with manure?

W-VG:314.

2. What are the best directions for mulching? W-VG:314.

3. *What other materials may be substituted for manure in mulching?* W-VG:314.

18. Blanching. — American markets demand well-blanchled celery. The light-colored stalks are obtained by forcing the plants to grow in darkness or subdued light. In the absence of full light, the coloring matter of the green stalks is destroyed and additional chlorophyll or coloring matter cannot be formed to any considerable extent. Blanching also improves the quality of the celery by making it more crisp and tender.

Early celery is always blanched in the field where it is growing,

while late celery may be partly or wholly blanched in the field or it may be harvested and blanched in storage.

Until within recent years, boards were used almost exclusively in blanching the early crop. Boards a foot wide and of any convenient length are stood on edge and leaned against the plants



FIG. 37.—Plows are used in the larger commercial fields for the ridging or blanching of celery.

on both sides of the row and held in place by stakes or other convenient devices. Self-blanching varieties require about two weeks to make the plants sufficiently light in color to satisfy market demands. In recent years long strips of fairly heavy paper are being substituted for boards. These are stretched along the rows and held in place by a little soil or perhaps by wire devices

made especially for the purpose. When boards are given the proper care they will last for years, and many growers of comparatively small areas continue the use of boards.

Late celery is generally ridged with soil to some extent in the field for the purpose of blanching the stalks. This operation generally begins with the cooler fall weather. If started too soon, when the weather is warm, the stems may be discolored more or less. Hilling hoes and shovels may be used in small plantations to ridge the plants, while plows and special horse-drawn hillers are employed in the large commercial plantations.

1. What kind of celery do American markets demand?
W-VG : 315.
2. How does blanching affect the color, texture, and quality of celery? W-VG : 316.
3. Describe the different methods of blanching early celery.
Late celery. W-VG : 316-318. L : 137. C : 202-204.
4. How much lumber or paper will you need to blanch your crop?
5. What is chlorophyll and under what conditions is it formed?
6. Describe the physiological effects of blanching.
7. Secure all the information you can about celery hillers, blanching paper, and machines used to apply the paper. Inquire of growers. Write manufacturers.
19. Combating insects and diseases. — Fortunately celery does not have many serious insect enemies. The carrot rust fly, a native of Europe, is an insect which seriously dwarfs celery stalks through the destruction of the fibrous roots by maggots. The whitish sickly plants seldom outgrow the attack unless new fibrous

root growth occurs near the surface of the soil and even then the plants are small in size and of poor quality. The adult is a small dark green fly with a yellow head. Eggs are usually laid in cracks between the soil and the plant or on the plant. Young maggots hatch in about a week, feed on the roots, and when mature they make a cell in the soil in which to pupate. Adults emerge in late summer and deposit eggs, the maggots of which are often plentiful enough to injure the late celery. No definite remedy is known.

The celery butterfly, a beautiful black, swallowtail butterfly, is the adult of the destructive celery caterpillar so well known on account of its brilliant markings. It feeds on various allied plants, but is seldom found on other crops. The honey-yellow eggs are deposited singly on the leaves. They hatch into black and white banded caterpillars which when mature are green in color with strong black and yellow markings. Attention is often attracted to the caterpillar because of curious orange-red scent organs on its prothorax. Hand picking is a means of control.

1. *Describe the appearance of injury from rust fly on celery.*
CL : 181-185.
2. *How does this injury differ from its work on the roots of other plants?* CL : 183.
3. *What is the life history of the insect?* CL : 182-184.
4. *Is control practicable?* CL : 185.
5. *What is the life history of the celery butterfly?* CL : 188.
6. *Mention three noticeable facts about the caterpillar.* CL : 188.

7. Name five plant foods of the caterpillar other than celery.
CL : 186.

8. Describe the adult caterpillar. CL : 186-187.

Celery is attacked by two blight diseases, one called late blight and the other early blight or leaf spot. The early blight spots first appear on the older or outer leaves as yellowish areas. Later the spots turn brown around the outside and have a whitish center. Varieties differ in their susceptibility to this disease. Spraying with Bordeaux is effective if begun early and should really be started in the seed bed.

Late blight appears as a leaf spot in its early stages. Later very small black dots appear on the spots and also on the blanched leaf stalks. The leaves sometimes wilt in severe cases. If the disease becomes troublesome, the seeds should be disinfected. Soaking for fifteen minutes in a corrosive sublimate solution (1 : 1000) is the treatment. This solution is poisonous, must be handled with care, and never used in a metal container. The same seed bed should not be used successively. Spraying with Bordeaux will help to control the disease either in the seed bed or field.

1. How do the two blight diseases of celery differ in appearance ?
SH : 174-178.
2. What three control measures may be practiced to control the late blight ?

20. Harvesting and marketing. — If the crop is to be sold as fast as it is harvested, a convenient plan is to cut the roots a little below the surface of the ground so as to leave a short stub at the base of the plant. No attempt will be made here to describe the numerous methods of preparing the crop for market. It is sug-

gested that the grower visit his local markets and ascertain the method or methods preferred by the dealers and then exercise extreme care. If the plants are to be tied in bundles of three or more, it is likely that blue or red tape, one quarter inch wide and made for this special purpose, could be used to advantage. The plants should be trimmed of all discolored leaves or withered leaf stalks. They should also be thoroughly washed and sent to market in the most attractive condition.

1. When is celery ready to harvest? W-VG : 319. C : 205.
2. What is the most convenient way for you to harvest your crop? W-VG : 319. C : 205. B : 104-123.
3. How will you prepare your crop for market?
4. How do the large commercial growers harvest their crop?
5. Ascertain the methods of marketing employed by growers in the most important producing districts.
6. What should be the profits from an acre of celery?

21. Storing late celery. — Celery is severely injured by hard freezing and for this reason it is unwise to defer harvesting the crop very much later than November 1. There may be sections of the North where it is safe to leave the crop in the field with no protection until Thanksgiving, but the student gardener will show wisdom by not taking too much risk in this matter.

It is important for growers to understand that the crop must be stored where it will be protected from hard freezing and where the air is cool and fairly moist. If these conditions are kept in mind, there should be no difficulty in providing satisfactory storage.

For growers of comparatively small areas, perhaps the trench method is most satisfactory. The trench should be about a foot

wide and deep enough for the plants to be stood erect with their tops extending several inches above the top of the trench. The plants should be trenched when they are perfectly dry. They are lifted with some soil adhering to the roots and set close together in the trench. Boards nailed together in the form of a trough are placed over the trenches to shed the rain and protect the plants from cold. A little soil is thrown along the bottom of the boards when the weather gets colder, and later the boards are covered with manure sufficient to protect the plants during the severest cold weather. Should there be warm weather at any time after storing the crop, it will be an advantage to raise at least some of the boards a few inches above the ground and support them with blocks of wood or otherwise.

The late crop is often stored in special storage houses, cold frames, and especially constructed pits.

1. **What is the effect of hard freezing on celery?** W-VG : 321-322.

2. **When should late celery be stored?**

W-VG : 321-322. C : 89, 103, 208-210.



FIG. 38.—Trenching celery.

3. What are the most favorable conditions for the keeping of celery? W-VG:321-325. B:104-108.
4. What are the details of the trench system? W-VG:322.
5. What other methods may be employed in storing celery?
6. Describe a good celery pit.
7. What difficulties may be encountered in storing the crop?

Project VII. Growing Lettuce

Lettuce belongs to the chicory family, which ranks as one of the highest of all the plant families. The thistle family is closely related to it. Wild or prickly lettuce, from which cultivated lettuce is supposed to have originated, is a native of Europe, but occurs in many places in this country as a troublesome weed. The wild form and the common lettuce will readily cross. There are other species of wild lettuce which are natives of America. Salsify, chicory, and endive are close relatives. Lettuce is said to have been under cultivation for more than 2000 years.

The lettuce plant is an annual, a rather rapid grower, sending up a seed stalk in some form at the end of about the second month. The leaves are alternately arranged on the stems but vary greatly in shape and margins. The flowers are yellowish, the fruits vary in color, being white, black, yellow, or brown. The fruits are tipped with soft white or brownish bristles which enable them to float in the wind like a dandelion fruit. The numerous varieties of lettuce catalogued by seedsmen may be grouped into four botanical types: (1) *asparagus lettuce*, with distinctly narrow basal leaves; (2) *cutting* or *loose-leaved* lettuce, with broad basal leaves, deeply cut on the edges; (3) *head lettuce*, with broad leaves, smooth or nearly so on edges, and forming a compact roundish or flattish

head, and (4) *cos lettuce*, with leaves straight and stiff and forming a conical or cylindrical head.

1. Is the wild form of lettuce known?
2. When does lettuce produce seed?
3. What are the types of cultivated lettuce from the botanical point of view?

Project Outline

1. Why grow lettuce?
2. Selecting location.
3. Choosing varieties.
4. Obtaining seed.
5. Constructing the hotbed.
6. Constructing the cold frame.
7. Making plant boxes.
8. Making straw mats.
9. Starting early plants.
10. Preparing the soil.
11. Planting in the garden.
12. Sowing in the garden.
13. Companion cropping.
14. Irrigating.
15. Cultivating.
16. Combating insects and diseases.
17. Harvesting and marketing.
18. Forcing.

1. **Why grow lettuce?** — Lettuce is nearly always included in the planting of home gardens. It is also grown on an enormous scale for commercial purposes. The intensive market gardeners

of all sections of the country have found it profitable, and the truckers of the South and the muck farmers of the North have developed the industry to large proportions. For the reasons just given, the growing of lettuce by the student gardener or club member may not be a promising financial proposition. This matter should be carefully investigated before the growing of lettuce is decided upon as a business venture. At the same time the gardener should realize that the crop offers splendid business inducements if a satisfactory market is assured. The fact that it may be matured so early in the season that other crops may follow, and that it may be planted so closely together, appeals to village gardeners who have only very small areas under cultivation. The crop is easily grown and its culture is attractive to most vegetable growers.

1. Is your market well supplied with good lettuce?
2. Do you think the crop offers special opportunities for you? If so, why?
3. What is the commercial importance of lettuce?
W-VG : 351. C : 273.
4. In what parts of the country is lettuce largely grown for commercial purposes? W-VG : 351. C : 273.
5. What do you know about the history of lettuce? W-VG : 351.
6. What are its chief botanical characteristics? W-VG : 351. W : 140.
7. How is it generally served on the table?
8. What is its chemical composition? Its food value?

2. Selecting location.—Lettuce requires practically the same soil conditions as celery. (W : 128.) An abundance of decaying

organic matter is highly essential as is also a liberal and constant supply of soil moisture. Soils naturally fertile should be selected if possible. The sandy types are always preferred, and especially for compact heading varieties which thrive only in well-aërated soils.

1. What are the soil requirements for growing lettuce?

W-VG:355. C:275.

2. Have you a favorable soil for growing this crop?

3. In what parts of the country is lettuce grown on muck soils?

4. What is the nature of the soil in the large greenhouses where lettuce is grown for market? W-VF:210.

5. Describe the soil conditions of the gardens in your community where the crop is successful.

3. Choosing varieties.—Lettuce growers should become thoroughly familiar with the classification of varieties as described in W:140. In the selection of varieties, all depends on market demands, soil adaptation, climates conditions, and the season of the year when the crop is wanted. In the New England and eastern states the compact heading varieties, and there are many good ones, are grown almost exclusively, while in western sections the well-known loose heading variety, Grand Rapids, is largely grown. So many excellent varieties are found among home and commercial growers that an extended discussion would be required to cover the subject in a satisfactory manner. Students are urged to consult the references, local gardeners, seedsmen, and others who may be familiar with the requirements of climate, soil, and market of the locality.

1. What varieties of lettuce will be most likely to yield you the largest profits? What are your reasons?
Consult markets and seed catalogues.
2. How may varieties of lettuce be classified?
W-VG : 351, 354. C : 271.
3. Which are of the greatest commercial importance? W-VG : 353.
4. What do you know about the Grand Rapids lettuce? Big Boston? Tennis Ball? W-VG : 353. W-VF : 207.
5. What varieties are grown most extensively in muck soils?
6. What varieties should be selected for midsummer sales?
7. What varieties do your neighbors grow?

4. **Obtaining seed.** — All that has been said in previous project discussions applies to the obtaining of lettuce seed. The utmost care should be exercised. Only reputable seedsmen should be patronized. It is also possible to grow superior seed at home.

1. Where can you obtain good seed of the varieties desired?
2. Where do your neighbors buy seed?
3. How would you proceed to grow good seed at home?
W-VF : 209.
5. **Constructing the hotbed.** — Early plants may be started in hotbeds in the same manner as tomatoes and cabbage. (W : 44.)
6. **Constructing the cold frame.** — Early plants may be transplanted from the hotbed into a cold frame or the seed may be sown in the cold frame. (W : 46.)

7. Making plant boxes. — Paper plant boxes, though seldom used for lettuce, will be found valuable, especially if very large, stocky plants are desired. (W : 58.)

8. Making straw mats. — Straw mats are valuable to protect plants in the hotbed or cold frame. (W : 50.)

9. Starting early plants. — Early lettuce plants are often started under glass, when practically the same methods are em-

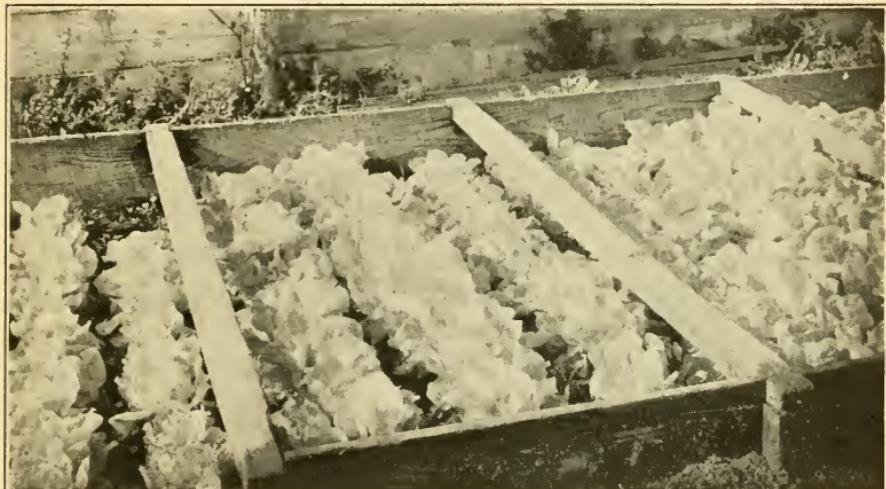


FIG. 39.—A well-constructed cold frame containing a crop of forced lettuce.

ployed as in the growing of early cabbage plants. The seed is generally sown somewhat later than early cabbage. If the seeding is made about February 15, the plants should be ready to set in the cold frame March 5, and in the field April 15, or a week earlier, if the weather has been warm and sunny.

It is important to have plenty of humus in the soil that is used to start early plants. It is also desirable to be liberal in the space allowed for the plants. While good plants may be grown when set $1\frac{1}{2} \times 1\frac{1}{2}$ inches apart in the cold frame, 2×2 inches apart will produce much stronger plants and it often pays to allow the

extra space, especially when a very early product is desired. When assured of a good price, we may be more than justified in using paper pots for starting the plants. These may be two inches square. They are conveniently handled by placing them in flats which may be shifted at your convenience.

1. How may early lettuce plants be started under glass?

W-VG:355. L:115. C:276.

2. When should the seed be sown?

W-VG:355. L:115. C:276.

10. Preparing the soil. — The instructions given for preparing soil for celery (W:128) apply equally well for lettuce. The student should also refer to W:122. Any lack of humus, soil moisture, or available plant food is certain to affect the yield as well as the quality of the crop. The maturity of the crop is also retarded by any unfavorable soil condition. It is exceedingly important, therefore, to be most thorough in the preparation of the soil for this crop.

11. Planting in the garden. — Lettuce grows best at comparatively low temperatures. For this reason advantage should be taken of the spring and fall months, thus avoiding as much as possible the hot weather of midsummer, the tendency of which is to cause the plants to produce seed shoots and loose leafy heads instead of compact ones. It is desirable, therefore, to set the plants in the open ground almost as early in the spring as the soil can be prepared. It is generally safe in most northern sections to begin transplanting into the field about April 15. If the plants have been properly hardened, they will stand hard freezing in the field.

Planting distances for lettuce vary greatly. Ordinarily 10×12 inches apart give ample space for the development of good heads. Plants are often set closer when the most intensive methods are

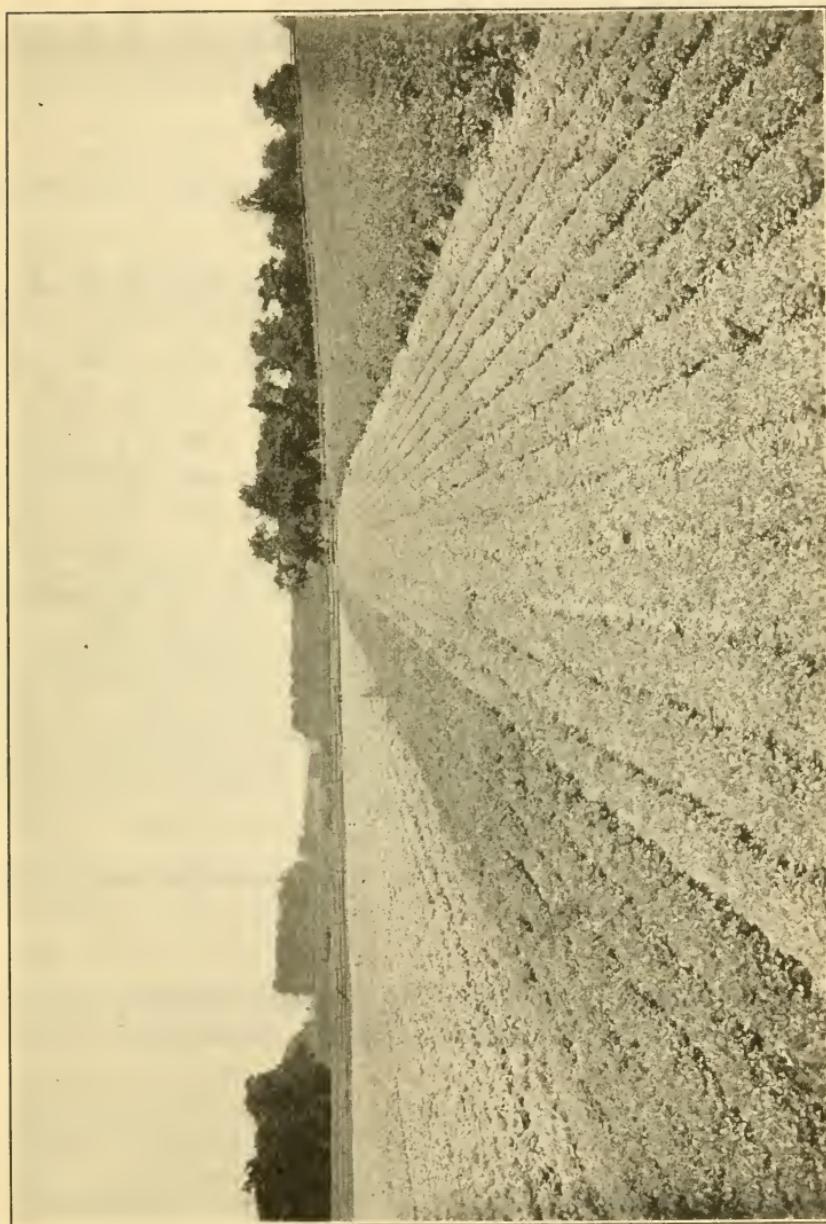


FIG. 40.—A perfect stand of lettuce. Note straight rows.

employed, and more space is allowed by growers who need not economize in area and who, perhaps, cultivate the crop with a horse. The plants should be shifted to the open ground with the least possible disturbance of the roots.

1. What temperature conditions are most suitable for growing lettuce? W-VG : 354.
2. What are the effects of hot weather on lettuce? W-VG : 354.
3. How far apart should lettuce be planted?
W-VG : 357. L:115. C:275.
4. When should the plants be set in the open ground? W-VG : 357.

12. Sowing in the garden. — The great commercial areas of lettuce are grown from seed sown in the open ground. It is customary to make the rows twelve to fourteen inches apart and to thin the plants to about a foot apart in the row. The seed should be covered by not more than one fourth inch of soil. The thinning may be done very rapidly with common hillng hoes, cutting out the weak and surplus plants.

1. Where is the seed sown for the large commercial plantations?
W-VG : 357.
2. What methods are employed in sowing and thinning, and how far apart should the plants stand? W-VG : 357. C:277.

13. Companion cropping. — Lettuce is very generally employed as a companion crop. Its use with cabbage is described in W : 102. Various combinations are given in W-VG : 477, 478, 480, 482, and 488.

14. Irrigating. — Lettuce, as previously stated, requires an abundant and constant supply of soil moisture, and for this reason the crop is often irrigated with the overhead system as described in W : 132 for celery.

15. Cultivating. — Lettuce requires thorough tillage, and wheel hoes or horse cultivators should be used as often as may be necessary to keep the surface of the soil in proper condition.

16. Combating insects and diseases. — Lettuce is attacked by such pests as slugs, millipedes, cutworms, plant lice, webworms, and beetles. Most of these are only occasionally troublesome, but at times may cause serious damage. Roots of lettuce are often infested with small whitish, waxy lice (lettuce root louse) which if abundant may arrest the growth of the plant. Ants usually occur about such colonies and may carry the lice to the roots of other plants.

Drop is one of the most serious lettuce diseases in regions where this crop is grown on an extensive scale. It gets its common name from the dropping of the leaves. The outer leaves wilt and droop and soon the whole plant collapses and lies flat on the ground. The disease works rapidly. At first whitish, cotton-like growths of the fungus are noticeable and later small, blackish, irregular bodies are definite signs of the disease. Prompt destruction of diseased plants is recommended. It is well to sprinkle the soil with Bordeaux in areas where diseased plants have appeared and have been removed. Several other diseases caused by molds, mildews, and bacteria may be troublesome. In all cases attention to cultural conditions and sanitation are important factors in control. Leaving diseased plants in place or using compost contaminated with diseased parts of plants are practices which tend to spread diseases.

1. *What relation do ants bear to colonies of root lice among which they work?* CL : 259.

2. *How does lettuce drop affect the plants?*

SH : 196-198.

3. *What practices are recommended for the drop and other lettuce diseases?*

17. Harvesting and marketing.—A great diversity of packages are used in marketing lettuce. The ordinary bushel basket is gaining in popularity, though smaller baskets of various descriptions are in common use. The lettuce should be washed and trimmed of all dead and wilted outside leaves.

1. *What is the best plan for you to follow in marketing lettuce?*

2. *Give a description of the various packages used in marketing lettuce.*

W-VG : 358. W-VF : 230. Inspect your market.

3. *How is the greenhouse crop sold?* W-VF : 230-233.

18. Forcing.—An immense quantity of lettuce is grown in greenhouses and cold frames. Students will find a complete discussion of this subject in W-VF : 204-234, 387-396, 403-404.

When the crop is grown in cold frames, the soil is made very rich and the plants are set about 8×8 inches apart.

CHAPTER FIVE

VINE CROP PROJECTS

Cucumber, Muskmelon, Watermelon, Squash, Pumpkin

The vine or cucurbitaceous group of vegetables includes the cucumber, muskmelon, watermelon, squash, and pumpkin. While they are classed as "tender" vegetables, they vary greatly in their temperature requirements. The cucumber, pumpkin, and squash are grown with entire success even in the coolest parts of the North, while the muskmelon and especially the watermelon are exacting in their requirements, especially with regard to soil. The cucumber and early varieties of squash mature with comparatively short summers, but the muskmelon, watermelon, and pumpkin require fairly long seasons, as do late varieties of squash.

All of the cucurbits thrive in sandy loams, and, wherever climatic conditions are unfavorable, liberal applications of well-decayed stable manure are highly advantageous.

Project VIII. Growing Cucumbers

The cucumber belongs to the gourd family. The members of this family are often referred to as cucurbits, a word derived from the botanical name of the family. There are about 650 species in the family, found mostly in the tropics. The cultivated species are warm weather crops and are easily injured by frost. Other well-known plants of this family are the pumpkin, squash, watermelon, and muskmelon. The cucumber is a native of Asia and

Egypt. It has been under cultivation there for more than 3000 years. It is not known in the wild state.

The cucumber plant is an annual with rough trailing stems, more or less branched, and often of considerable length. The leaves are simple and somewhat five-lobed. The flowers are yellow. The fruit is known as a pepo, a fruit with hard rind and seeds immersed in a pulpy interior. The rind is not separable, does not break open at maturity, and, although rough and spiny when young, sometimes becomes smooth. Common cucumbers are divided into white spine varieties and black spine varieties. There is an English forcing cucumber which produces seedless fruit owing to the fact that the flowers set fruit without being fertilized. Small cucumbers are often used as gherkins, but there is a genuine gherkin belonging to a different species, a native of the West Indies. There seems to be a popular idea that the cucumber and melon may be crossed, but experiments have not shown this to be true.

1. *To what family does the cucumber belong?*
2. *What term is used to refer to members of this family?*
3. *What kind of weather is favorable to the cucumber?*
4. *What character is used in dividing common cucumbers into two groups?*
5. *How are seedless cucumbers produced?*

Project Outline

1. Will cucumbers pay?
2. Selecting location.
3. Choosing varieties.
4. Obtaining seed.

5. Starting early plants.
6. Preparing the soil.
7. Transplanting in the garden.
8. Planting seed in the garden.
9. Companion cropping.
10. Cultivating.
11. Combating insects and diseases.
12. Harvesting and marketing.
13. Forcing.

1. Will cucumbers pay? — Whether they pay or not will depend mainly on two factors, namely, whether you have suitable conditions for the growing of cucumbers, and whether your market is generally well supplied with this vegetable. When considering the commercial possibilities of this crop, we should also bear in mind that a fairly large area is required in order to grow a considerable quantity, and for this reason it is not a suitable vegetable for cultivation on a very large plot which is expected to yield maximum financial returns. In other words, it is necessarily more of a field proposition and should have serious consideration wherever cultural conditions are favorable, provided there is a promising market. There is usually a good demand for small pickling sizes. The crop is easily grown and does not require a large amount of labor.

- 1. Will it pay you to select cucumbers for your home project?**
- 2. Do you have a suitable location? W-VG : 332. L : 217.**
- 3. Is your market well supplied with cucumbers?**
- 4. Is it a desirable crop for intensive cultivation on a small area?**
- 5. What are the labor requirements of this crop?**

2. Selecting location. — W: 151, 153. The cucumber is not only sensitive to frost but extreme heat with a lack of abundant moisture is also unfavorable to its best development. It is grown very largely in many parts of the South for shipment to northern markets, and immense quantities are produced in certain sections of the North for pickling purposes. In addition to supplying these demands, it is grown locally for perhaps every market in the United States.

The early crop makes most rapid advancement in light, sandy soils, while late cucumbers bear longer and yield better in the fairly heavy soils. Any deficiency in plant food or soil moisture is certain to affect the growth of the plants as well as their ability to produce a good crop. It is desirable, therefore, to select a relatively fertile soil, though the proper treatment of soils of average fertility should result in a satisfactory crop of cucumbers if all other cultural requirements are met.

- 1. What are the temperature and climatic requirements of the cucumber?** W-VG: 331. L: 236.
- 2. What kind of soil is best for early cucumbers? For late?** W-VG: 332. C: 233.
- 3. Describe the soil and location on your farm which you consider suitable for cucumbers.**

3. Choosing varieties. — Most varieties of cucumbers grown in American gardens have originated from an old and well-known variety, the White Spine. This variety is sold by all seedsmen, as well as numerous varieties originated from it, such as the Chicago Pickling, Boston Pickling, and Fordhook Pickling.

- 1. What is the most important variety grown in the United States?** W-VG: 331. Seed catalogues.

2. What other varieties are largely grown?

W-VG : 331. Seed catalogues.

3. What variety will you grow?

4. *What is the history of the cucumber?* W-VG : 330. C : 230.

5. *What are the chief districts where cucumbers are grown for pickling or for marketing?* W-VG : 331.

6. *What varieties are planted for forcing purposes?* W-VF : 302.

7. *What varieties should be selected for very small pickles?*

8. *What are the chief botanical characteristics of the cucumber?*
W-VG : 331. C : 230.

4. Obtaining seed. — It is not generally difficult to obtain seed for the outdoor crop of cucumbers from the best-known seeds-men. The growers of greenhouse cucumbers generally select their own seed from special plants, and by this means a high standard of excellence is maintained. A considerable number of truckers also save home-grown seed, which is not a difficult matter if the general principles and practices are observed as explained for tomatoes in W : 43.

1. Where can you obtain good cucumber seed?

Consult growers. Seed catalogues.

2. Is it desirable to select your own seed? If so, give directions.
W-VF : 306-308.

3. Where should the seed be stored? How long will it retain its vitality?

4. How much seed will you need?

5. Starting early plants. — Earliness is an exceedingly important factor in making cucumbers pay. It is so important that many growers start at least a portion of their plants under glass. This may be done in a greenhouse, or hotbed, and even a cold frame may be used to advantage, although artificial heat is essential if good plants are wanted for setting in the open ground as soon as weather conditions will permit. The night temperature in the greenhouse or hotbed should not be less than 60° and the day temperature at least 10° higher.

The seed should be planted about four weeks in advance of the date when it is considered the plants may be safely transferred to the garden. In most parts of the North, it is not safe to set the plants out before May 10 to May 20 and ten days later in some sections. This means, of course, that the weather will be comparatively mild during the growing of the plants and that it will be unnecessary to make provision for very much heat in the hotbed. A hotbed containing only a foot of hot manure should be satisfactory for this purpose in all parts of the North.

Two methods are employed in starting the plants. One, which is the most common among market gardeners, is to plant six to eight seeds in a three or four inch earthen or paper pot (W : 58) and then thin to two to four strong plants. The other plan is to sow the seed in flats or beds, barely cover them, and then transplant, when the seedlings are about a week old, to pots or other devices. The second plan is used extensively by greenhouse growers of cucumbers, but with good management either plan is satisfactory. Sometimes the plants are started in berry baskets, or in tough, inverted sods, cut into squares of about six inches.

Watering must have careful attention, for either overwatering or insufficient soil moisture may be disastrous to the plants. The soil should be light and fertile.

1. What importance should be given to earliness in the growing of cucumbers in the North for local market?

2. What temperatures are required in the growing of early plants?

W-VG : 333. C : 233.

3. How may the plants be started? W-VG : 332. L : 223.

4. When should the seed be sown?

5. How should the hotbed be made for starting early cucumber plants? W : 156.

6. Describe the soil which will be most suitable for starting the plants.

6. Preparing the soil.—There are probably very few soils if well drained, where cucumbers cannot be grown with entire success. The matter of good drainage should be emphasized. It is also important for the soil to be well supplied with humus and plant food.

Heavy clover sods, plowed down as early as possible in the spring, furnish ideal physical conditions, and such soils are usually rich in nitrogen. The land may be of such a character that it will be unnecessary to apply manure in any considerable amount, although this is unlikely. The most successful growers do not take chances in this matter, and for this reason they use rotten manure as liberally as the supply will permit. Manure should be applied in the hills or in drills. A large shovelful or two in each hill will be found highly beneficial. Perhaps manure may be so plentiful that three or four shovelfuls may be applied in each hill and mixed with the soil. In some sections cucumbers are planted in drills and in this event the manure should be distributed in furrows opened with a plow, some soil being plowed back on the manure and mixed with a cultivator before drilling in the

seed. Whatever the plan followed, there should be no uncertainty about using the required amount of manure.

Commercial fertilizers may also be used to advantage. If the soil is naturally very fertile, or if stable manure has been used with great freedom, an excellent crop of cucumbers may be grown without supplementing with commercial fertilizers. It is rarely, however, that the use of fertilizers will not increase the profits.

When a very early crop is desired, the use of nitrate of soda may be a distinct advantage. It should be applied at the rate of about a tablespoonful mixed very thoroughly in each hill before the crop is planted. Top dressing with nitrate of soda during the period of growth may be beneficial, but excessive amounts should be avoided, or the plants may be injured. A teaspoonful of nitrate sprinkled around each hill at intervals of about three weeks will probably be as much as can be used with safety.

It is also highly probable that the use of 500 to 700 pounds of acid phosphate to the acre will add to the profits of the crop. Potash, at normal prices, may also be profitable. Both of these mineral elements should be applied after the land has been plowed and then mixed with the soil by thorough harrowing.
W : 63.

1. What may be said about drainage in relation to growing cucumbers?
2. What crop or crops should precede the cucumber?
3. Should stable manure be employed in growing cucumbers?
If so, how much, and how and when should it be used?
W-VG : 333.
4. Do you recommend the use of commercial fertilizers? If so, what kind and how and when should they be applied?
W-VG : 333. C : 233.

5. *What relation, if any, has the character of cucumber roots to the preparatory treatment of the land?*
6. *What is the chemical composition of the different parts of the cucumber plant?*
7. *Does your particular soil need lime for growing cucumbers?*
8. *How do the market gardeners of your community treat their soils for the growing of cucumbers?*
7. **Transplanting into the garden.** — Every possible effort should be made to have the soil fine and moist at the time the plants are transferred from the hotbed to the open ground. If the soil is in proper condition, there should be no loss of plants due to transplanting.

The proper time to set the plants in the open ground is wholly a local question. We should bear in mind that the cucumber is easily injured by frost, and that no amount of hardening in the hotbed or cold frame will enable the plants to withstand it. Each grower should make careful inquiry among old residents and ascertain the date when it is probably safe to plant in the field.

The plants should be taken from the pots with the least possible disturbance of the roots. Holes for the balls of earth should be made amply large and the soil should be pressed gently around the balls of earth so that they will not be broken.

Planting distances for cucumbers are extremely variable; 5×5 feet apart is practically always satisfactory, even in the most fertile soils, and in thin, light soils less space may be allowed.

1. **When should pot-grown cucumber plants be transferred to the open ground?** W-VG:334. C:232.
2. **Give specific directions for setting pot-grown plants.**
W-VG:334. C:232.

3. At what distances do you think you should set your plants?
W-VG : 334. C : 233.

4. Make a thorough study of the roots of the cucumber.

8. **Planting seed in the garden.** — The bulk of the cucumber crop is grown from seed, sown in the open ground. The soil should be properly prepared as explained in W : 157 and the seed planted at the distances suggested in W : 156.

Inasmuch as the seed does not germinate for several days after it has been planted, it may be placed in the hills or drills probably a week earlier than it is desirable to set the hotbed grown plants in the open ground. Another factor to be considered in this connection is that the expense of starting a second lot of plants in hills is so slight that growers often take chances, and if the first lot is destroyed a second sowing is made. The seed need not be covered with more than half an inch of soil. After the plants are well started, they must be thinned to three or four in each hill.

1. When should cucumber seed be planted in the open ground?
W-VG : 334. C : 233.
2. How many seeds should be planted in each hill and how deep should they be covered?
W-VG : 334. C : 233.
3. When should the plants be thinned and how many should be left in each hill? W-VG : 334. C : 233.
4. Do the growers of your community start their plants under glass or sow seed in the open ground?
5. Study the germination of the cucumber seed before making the main planting in the hotbed or garden.

9. Companion cropping. — The cucumber is not extensively grown as a companion crop with other vegetables. Perhaps the bean is grown with it more generally than any other vegetable. There may be advantages in doing this, for rows of bush beans alternating with rows of cucumbers furnish considerable protection to the young cucumber plants. This vegetable is not only injured or killed by frost, but it is greatly checked in growth by cold winds. The beans grow very rapidly so that they soon make quite an effective windbreak for the small cucumber plants. Again, the beans will be harvested and the plants may be removed before they interfere in any way with the development of the cucumber crop. If there is more than a five-foot space between the rows of cucumbers, it may be possible to intercrop with two rows of bush beans. Sweet corn may also be grown between cucumbers, and the partial shade seems to be favorable to the cucumbers.

1. *Do you think it would pay you to grow beans between the cucumber rows?*
2. *Do you know of other crops that might be grown with the cucumber?*

10. Cultivating. — The cucumber should receive thorough tillage. Some hoeing and hand weeding are generally necessary in and about the hills. W: 68.

1. **What implements will you need to cultivate the cucumbers?**
2. **How often should the cucumbers be cultivated?**

11. Combating insects and diseases. — CL: 109-140. The cucurbits probably suffer from insects more than almost any other group of plants. From the time the seed is planted until maturity, the crop is continually threatened by insects, many of which are very difficult to combat: In most instances only those

remedies are useful which render the plant distasteful, as the pests cannot be killed by the usual spraying practices.

The striped cucumber beetle is the familiar small yellow striped beetle which appears about the time the tender cucumber, squash, or melon leaves push through the ground. The beetles feed voraciously on the young cotyledons, which if left unprotected will be entirely destroyed. After satisfying their hunger, the adults deposit their light yellow eggs in the ground. The larvæ hatch in about one week and work down the stem or under the vines, burrowing into the tissue, sometimes completely riddling the stem just below the ground. When mature the grubs enter the soil and in late summer the beetles emerge to feed on wild plants until cold weather begins. As a means of control, Bordeaux mixture is a good repellent. Garden plots can be protected with cheesecloth. Arsenical poisons are not effective.

Cucurbits and melons are subject to several diseases which may be limiting factors in the production of the crop. Of these diseases the bacterial wilt, anthracnose, and mosaic are the most important.

Bacterial wilt is a disease caused by bacteria which are spread by the striped cucumber beetles. The young plants droop and die within a few days after being attacked. Spraying the plants with lead arsenate powder, one half pound or one pound of the paste form to ten gallons of water, will protect the plants from the beetles and thus indirectly prevent the disease.

Anthracnose attacks leaves, stems, and fruits and is often seen on the fruits when they reach the market. A definite sunken spot is produced which enlarges slowly until the rind is penetrated when a soft rot sets in and the entire fruit decays. The disease may be carried on the seed and therefore disinfecting the seed for five minutes in formaldehyde (1 teaspoonful to 1 pint water) is advisable. Spraying the plants with 4-4-50 Bordeaux is necessary to control the disease in the field. Rotation should be practiced.

Mosaic or "White Pickle" is a disease which causes a dwarfing and yellow mottling of the leaves and fruits. Infected plants produce few if any fruits. Removing and destroying the diseased plants as soon as they appear and dusting the patch with equal parts of tobacco and lime or spraying with nicotine sulphate (1 teaspoonful to 1 gallon of water) to control the aphids will tend to keep this disease from spreading.

1. *Why is the beetle so injurious to young plants?* CL: 110.
2. *Where do the larvæ work?* CL: 109-110.
3. *What is its life history?* CL: 110-111.
4. *Describe three control practices.* CL: 111-112.
5. *What other beetles affect the cucumber?* CL: 113-115, 133.
6. *How is the bacterial wilt spread?* SH: 182.
7. *What parts are attacked by anthracnose and what are the most characteristic symptoms?* SH: 180-181.
8. *How may mosaic be diagnosed in the field? What are the approved methods of combating it?*

12. Harvesting and marketing.—Cucumbers should be harvested whenever they have attained a size wanted by your market. Sometimes such a good price can be obtained for the very small pickles that it does not pay to allow them to grow to any considerable size. However, the early market generally wants large cucumbers and good prices are paid for them, and the small pickles are produced and sold later in the summer or perhaps in the early fall.

It pays to grade cucumbers and to pack them in clean, attractive packages. They may be sold by the dozen, by the hundred, or

perhaps by the bushel. Growers should investigate the markets to be supplied and try to improve on the methods commonly employed.

1. At what stage of development should cucumbers be harvested for your market? C:239.
2. Will it pay you to grade your cucumbers? If so, how? C:239.
3. What packages should you use? C:239.
4. How many packages will you need to market your crop?
5. *What should an acre of cucumbers yield in bushels and in dollars?*
W-VG:336.
6. *Is it more profitable to grow small pickles than large, early cucumbers?*
7. *What recipes might be used in pickling cucumbers of different sizes?*
8. *What is the nutritive value of cucumbers? How may they be served other than as pickles?*
13. **Forcing.** — The cucumber is very largely grown in American and English greenhouses. Students who are interested will find a complete discussion of the subject in W-VF:300-345.

Project IX. Growing Muskmelons

The muskmelon is one of the cucurbits belonging to the same genus as the cucumber. It is supposed to be a native of East India. The plants are annual trailing herbs. Melons are true fruits. They vary considerably in shape and size. The fruit is botanically known as a pepo. This name applies to all fruits of

the gourd family. The outer rind is hard and the inner portion is softer and edible. There are several rather well-defined botanical varieties of muskmelons, based largely on the character of the fruits. *Netted melons* include the common muskmelons. They are shallow-ribbed melons. The skin is usually netted, although sometimes almost smooth. The flesh may be green or salmon tinted. *Cantaloupes* or *Rock melons* are deeply furrowed or ribbed, have hard rinds, and are more or less scaly or warty. The so-called Rocky Ford Cantaloupes do not belong here; they are netted melons. *Pineapple melons* are similar to the netted melons, differing chiefly in their oblong shape. *Snake melons* have fruits many times longer than broad, greenish when ripe, and curved and furrowed.

1. *What garden crops are very close relatives of the muskmelon?*
2. *What is the character of the melon fruit?*
3. *Upon what characters are the botanical varieties of melons largely based?*

Project Outline

1. Will muskmelons pay?
2. Selecting location.
3. Choosing varieties.
4. Obtaining seed.
5. Starting early plants.
6. Preparing the soil.
7. Transplanting into the garden.
8. Planting seed in the garden.
9. Companion cropping.
10. Cultivating.
11. Combating insects and diseases.
12. Harvesting and marketing.

1. Will muskmelons pay? — Muskmelons of high quality nearly always command good prices. Now and then we find a commercial grower who almost invariably produces muskmelons of superior merit, and in all such instances the demand far exceeds the supply. Consumers are constantly seeking melons of high quality and any producer who can grow them need not worry about a market.

The production of muskmelons as a business proposition should not be undertaken unless the grower is assured that he has favorable conditions for the growing of good melons. If he has this assurance there is no reason why he should not make a business venture with this crop. However, it should be borne in mind that the production of muskmelons is considered a more difficult proposition than the growing of cucumbers, but it is also more fascinating, especially when the fruits attain the edible stage.

1. What can be said about the demand for high-grade muskmelons?

2. Do you think it would pay you to grow muskmelons?

2. Selecting location. — We should bear in mind that the muskmelon is tender to cold and that we should select areas, if possible, well protected from the prevailing winds. With few exceptions, the large commercial plantations are made on sandy or gravelly soils because they are warmer and more favorable to the culture of this crop. Muskmelons may be grown with entire success in thousands of localities in the North where there are sandy areas, and many other soil types may be treated so as to grow at least fair crops.

1. What are the most important factors in selecting a location for the growing of muskmelons?

W : 166. W-VG : 363, 364. L : 220.

2. *Are muskmelons grown in your neighborhood? If so, on what kind of soil? What is the exposure? Is there any protection from prevailing winds?*
3. *Where are muskmelons most largely grown in the United States?*
C:294.

3. Choosing varieties. — There are so many varieties of muskmelons that it is usually a perplexing question to decide which ones will be most likely to give satisfactory results. The experience of local gardeners, if they grow muskmelons, should prove exceedingly helpful. Certain types often prove most valuable for a given district. This whole problem should be investigated very carefully before any decision is made. It will be found in W-VG:361-363 that there are numerous types and these vary greatly in size, shape, markings, and color and quality of flesh. Among the varieties most largely grown may be mentioned Rocky Ford, Emerald Gem, Montreal, Paul Rose, and Osage or Miller's Cream. The last-named variety is excellent for the local markets of most parts of the North.

1. *What varieties of melons do you think should be planted for your local market? What are your reasons for selecting them?* W-VG:361-363.
2. *What is known about the history of the muskmelon?* W-VG:360.
3. *What are its chief botanical characteristics?* W-VG:360. W:164.
4. *Name the most important types and the leading varieties of each type.* W-VG:361. C:297.
5. *Secure samples of as many varieties as possible and classify them. How do they differ in color, texture, and quality of flesh?*

4. Obtaining seed. — The utmost care should be exercised in purchasing or selecting seed. It is easily possible to make a complete failure in the growing of a good crop by the use of poor seed.

1. Where can you purchase good muskmelon seed?

2. How would you proceed to grow and select your own seed?

W-VG : 364.

5. Starting early plants. — Early muskmelon plants may be started under glass in the same manner as early cucumber plants. W : 156.

6. Preparing the soil. — The preparation of soil for muskmelons does not differ essentially from the preparation of soil for cucumbers, though it may be necessary to exercise more care where the soil and climatic conditions are not naturally favorable for muskmelons. In the small home garden we may go to the trouble of mixing sand with manure in the hills so as to provide the best physical condition. W : 52.

7. Transplanting into the garden. — Pot-grown plants are transplanted into the open ground in the same manner as cucumbers, but more space should be allowed; 6×6 feet apart is the most common distance for the planting of muskmelons. W : 159.

8. Planting in the garden. — Seed may be planted in the garden in the same manner as cucumbers except that the hills should be about 6×6 feet apart. W : 156. W-VG : 370-373. L : 220-223. C : 295.

9. Companion cropping. — Any system of companion cropping suitable for cucumbers will be found equally satisfactory for muskmelons. W : 161.

10. Cultivating. — The muskmelon requires thorough tillage until the crop is well advanced.

1. What kind of tillage would you recommend for muskmelons?

W-VG : 373.

11. Combating insects and diseases. — Melon vines are visited by a small black louse (melon aphis) which curls the leaves, causes the fruit to ripen prematurely, and makes it worthless. If left unchecked the lice may eventually ruin an entire crop in a very few days. The life history of this species is not well understood, but as it feeds on a number of wild plants, these probably are the centers from which it is distributed to the field. The pest has a large number of natural enemies which under favorable circumstances may check its increase. Fumigation of young plants is one means of control, and spraying with nicotine soap solution is a practical remedy in large fields.

Diseases may also cause considerable loss, and to guard against their ravages some growers spray systematically with Bordeaux mixture.

1. *Why is the melon aphis a dangerous pest?* CL : 136.
2. *Does it have any insect enemies?* CL : 136-137.
3. *What are the principal control measures?*
CL : 137-138. W-VG : 376.
4. *What are the most serious diseases and what steps should be taken to control them?*
W-VG : 376. L : 229. C : 296-297.

12. Harvesting and marketing. — The quality of muskmelons will be sacrificed unless they are fully ripe when harvested. Some experience is necessary in order to avoid making too many mistakes by premature picking. The stems begin to separate from the fruit when ripe. In the marketing of high-grade fruits, there is an opportunity to resort to practice that will make the melons doubly attractive to both dealers and consumers. Some growers take the pains to wrap each specimen in waxed tissue paper and to market the melons in fancy packages.

1. When should muskmelons be picked? What effect has premature picking on the quality of the fruit? How can you tell when a melon is ripe? W-VG:373-375.
2. How should the fruits be graded for market? C:298.
3. *What should be the yield of muskmelons to the acre?* W-VG:376

Project X. Growing Watermelons

The watermelon is a member of the gourd or cucurbit family but belongs to a group quite separate from the muskmelons. The plants are coarse; the stems are hairy, angular, and somewhat branching; the leaves are lobed and the flowers greenish yellow. The fruit varies in shape and size. It may in some forms reach a weight of twenty-five pounds. The rind varies in thickness and is firm. The inner portion is tender, watery, and pulp-like, usually reddish, but in some forms purplish or white. The watermelon is a native of tropical Africa and has been in cultivation since prehistoric times.

Project Outline

1. Will watermelons pay?
2. Selecting location.
3. Choosing varieties.
4. Obtaining seed.
5. Starting plants.
6. Preparing the soil.
7. Transplanting into the garden.
8. Planting seed in the garden.
9. Cultivating.
10. Combating insects and diseases.
11. Harvesting and marketing.

Most of the general instructions given under Project VIII, "Growing Cucumbers," and Project IX, "Growing Muskmelons," are equally applicable to the growing of watermelons. The most important differences are pointed out in the following paragraphs.

1. Will watermelons pay? — There are a few sections of the North where the watermelon should have serious consideration as a home project. As previously stated the plant requires high temperature and a long season. If both soil and climatic conditions are favorable and a good market available, there is no reason why it should not be produced at a profit.

- 1. Will it pay you to grow watermelons for market?** L:231.
- 2. Where are watermelons most extensively grown for commercial purposes?** W-VG:467. L:231. C:455.
- 3. What is the history of the watermelon?** W-VG:467. Trp:1.
- 4. How does it differ botanically from the muskmelon?**
Trp. 2-8. C:456.

2. Selecting location. — The watermelon should have the lightest soil and the warmest location that can be found. An old pasture sod on a southern slope is extremely desirable.
W:153, 154, and 166. W-VG:468. Trp:9-17. L:231.

- 1. Describe in detail the most suitable location for the growing of watermelons. Do you have a location that satisfies these requirements?** W-VG:468. Trp:9-17. C:457.

3. Choosing varieties. — There are many good varieties of watermelons, and students should be familiar with the various classes as described in W-VG:467. Among the most popular varieties may be mentioned Kleckley Sweet, Kolb Gem, Cuban

Sweet, Halbert Honey, Dixie, and Sugar Stick. All of these varieties are listed and described in most of the seed catalogues. Cole and Fordhook are very early varieties and should have consideration for planting in districts which are not altogether suitable for the culture of melons.

1. What varieties do you think would do well in your locality?

2. What varieties are most valuable for planting where the soil and climatic conditions are rather unfavorable for melons?

W-VG : 468. C : 461. Seed catalogues.

3. Are melons grown in your neighborhood? If so, what varieties?

4. Obtaining seed. — Excellent seed can usually be bought from dealers. Many commercial growers select their own seed. Trp. : 18-29.

1. Where and how may good seed be obtained?

W : 155, 168. W-VG : 468. Trp : 18-29.

5. Starting plants. — Early plants may be started under glass in the same manner as explained for cucumbers and muskmelons. W : 156. This is a distinct advantage in northern regions.

W-VG : 366. Trp : 35-40.

6. Preparing the soil. — In the North, even more care should be exercised in preparing the soil for watermelons than for cucumbers and muskmelons. Select an old pasture sod, manure heavily with fresh strawy manure and plow in fall, replow in the spring, and harrow thoroughly. It is important to use in the hill an abundance of well-decayed stable manure. If a limited number of hills are to be planted, it may pay to mix a few shovelfuls of sand in each, besides manure and perhaps a little commercial fertilizer.

Bone meal is especially valuable for mixing in the hill for this vegetable.

1. What are the best directions for preparing the soil for a successful crop of watermelons on your farm?

W:172. W-VG:369. Trp:30-34. L:231. C:457.

7. Transplanting into the garden.—The plants started under glass should be transplanted into the field in the same manner as explained for cucumbers and muskmelons (W:159), except that the hills should be about 10×10 feet apart.

W-VG:469. Trp:35-40.

8. Planting seed in the garden.—The common practice is to plant the seed in hills about 10×10 feet apart, after the danger of killing frosts is practically past. Plenty of seed should be used in each hill in order to insure a good stand of plants, and then they should be thinned to three or four of the strongest.

W:160. W-VG:369, 469. Trp:41-45. C:459.

9. Cultivating.—Watermelons should have thorough tillage. Some hand-hoeing is always necessary.

W:161, 168. W-VG:373. L:232. C:459.

10. Combating insects and diseases.

W:161, 169. Trp:68-89. C:460. CL:109.

11. Harvesting and marketing.—Growers cannot be too careful in harvesting the melons at the proper time to secure the highest quality. It is largely a question of experience, but the observing student should not make many mistakes in this matter.

Trp:46-60. C:462.

1. How can you determine when a watermelon is ripe enough to pick? W-VG:469. Trp:46-60.

Project XI. Growing Squashes

The words squash and pumpkin are rather loosely used to apply to various *cucurbits*. There are three different species and nu-

merous varieties to which these names are applied. It is almost impossible to know just what is meant by the terms squash and pumpkin unless other descriptive terms are used. The name squash is said to be adapted from an American Indian word. Some of the forms were being cultivated by the Indians when America was discovered, others are doubtless natives of tropical Asia and Africa.

In some forms the plants are bushy; others have trailing vines. The stems are rough and the trailing forms have a tendency to root at the nodes. The various forms differ in the shape of the leaves and the character of the fruit stalk, as well as in the fruits themselves. Three species may be recognized which are variously subdivided. These three species may be roughly separated as follows:

(1) *Pumpkin*, *summer squash*, *crookneck*, *scallop*, and *gourd* (in part), having lobed leaves and ridged fruit stalks which are not enlarged next to the fruit.

(2) *Winter* or *Canada Crookneck squash* and *Cushaw* or pie pumpkin of the South, having lobed leaves and ridged fruit stalks which are much enlarged next to the fruit.

(3) *Hubbard*, *Turban*, and *Marblehead squash*, having leaves not lobed, fruit stalks not much ribbed.

In the first species, the true pumpkins, the plants have rather robust, long, trailing stems. This group includes the common and field pumpkins. The summer squashes, crooknecks, and scallops have bushy, more compact plants. In the summer squashes and crooknecks, the fruit has a narrow crooked neck and the rind is covered with warts or humps. The scallops have fruits broader than long, with scalloped edges and a smooth rind. The gourds have slender, running stems with fruits comparatively small and a very hard rind. They are not edible. In the second species the plants are compact, the fruit crooknecked and smooth. In the cushaw the fruit may be yellow, white, or striped. In the

third group is the well-known and popular Hubbard squash. It has been suggested that the term squash shall be reserved for this group. The leaves are not lobed and the stalks of the fruit not ribbed. In this species fruits are never crooknecked. The mammoth squashes belong here. These have been known to grow to large sizes, weighing a hundred or even two hundred pounds. Within the three species there is without doubt crossing between the varieties, but it is not believed that the species will naturally cross with one another.

1. *Why is it not possible to distinguish clearly between squashes and pumpkins?*
2. *What two kinds of plants are there?*
3. *What are the three principal characters used to distinguish the three species?*
4. *What precaution needs to be taken to prevent crossing of these various forms?*

Project Outline

1. Will squashes pay?
2. Selecting location.
3. Choosing varieties.
4. Obtaining seed.
5. Starting plants.
6. Preparing the soil.
7. Transplanting into the garden.
8. Planting seed in the garden.
9. Cultivating.
10. Combating insects and diseases.
11. Harvesting and marketing.

1. Will squashes pay? — This will depend mainly on two factors, first, whether you have a good market for squashes, and, second, whether you have a considerable area of well-drained land. The squash is not so exacting in its cultural requirements as the muskmelon and watermelon, and it may be readily grown throughout the North. The market demand, however, is very limited in most communities, so that we should be careful not to venture on too large a scale unless a good market is assured.

1. Will it pay you to grow squashes? W-VG : 427.

2. Selecting location. — Squashes may be grown with entire success in a great diversity of soil types. Good drainage is essential as is also high fertility. The sandy loams are preferred.

1. Do you have suitable soil and climatic conditions for the growing of squashes? W : 151. W-VG : 428. L : 240.

3. Choosing varieties. — The most important early bush or summer varieties are Early White Bush, Yellow Bush, Summer Crookneck, and Giant Crookneck. Winter varieties: Hubbard, Delicious, Essex Hybrid, and Boston Marrow. The Hubbard type is generally grown throughout the country.

1. What variety will be likely to pay you the best?

W-VG : 428. L : 237-240. C : 413-416, 420.

4. Obtaining seed. — Good seed may be purchased or saved from home-grown specimens. W : 43, 155.

5. Starting early plants. — Early plants may be started under glass in the same manner as other cucurbits.

W : 156, 157.

6. Preparing the soil. — The soil may be prepared in the same manner as for cucumbers or melons.

W : 157, 168. W-VG : 428. L : 240. C : 415.



FIG. 41.—Various types of squashes. They are extremely variable in shape, size, and color.

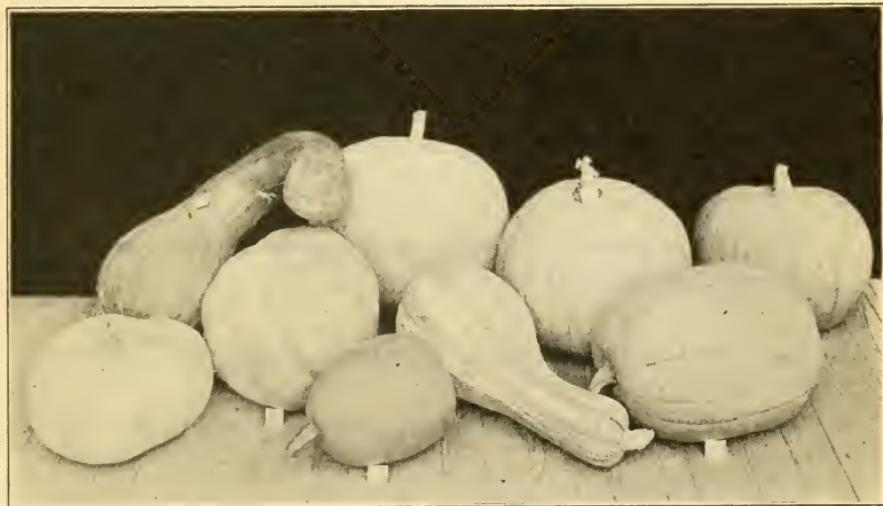


FIG. 42.—Squashes and pumpkins of the types shown in this illustration are especially desirable for the making of pies.

7. **Transplanting into the garden.**—Squashes may be transplanted in the same manner as other cucurbits.

W: 159.

8. Planting seed in the garden. — The early or bush varieties are planted in hills four or five feet apart each way, while the late sorts being vining are planted in hills ten to twelve feet apart.

W : 160. W-VG : 428, 429. C : 415.

9. Cultivating. — Thorough tillage for squashes is just as important as for the other cucurbits.

W : 161.

10. Combating insects and diseases. — Few insect pests are more widely known than the squash bug. The adult, a large brownish bug, passes the winter beneath rubbish, or in some convenient shelter. About the time squashes come up the bugs emerge and gather on the plants, sucking the juices and causing the leaves to wilt. The eggs, which are deposited in clusters on the undersides of the leaves, hatch in about six to fifteen days, and the grayish nymphs feed on the leaves for four or five weeks, reaching maturity in late summer. The adults are very resistant to contact sprays. Trapping the adults or spraying the young nymphs with tobacco decoction are the best remedies. Other sucking bugs attacking squash are horned squash bug, melon leaf bug, the southern and the northern leaf-footed plant bug.

1. Why is the squash bug more troublesome in gardens than in larger plantations? CL : 117.

2. Describe the appearance of an injured plant. CL : 118.

3. What is the life history of the squash bug? CL : 118.

4. Give three control measures. CL : 119.

5. What other insects attack the squash? CL : 119, 121.

11. Harvesting and marketing. — The crop should be handled with great care so as to prevent bruising, for any injury may be

the cause of decay when the squashes are placed in storage. They should be harvested before the time of hard frosts and stored in a dry room where they will not freeze. Be sure that each specimen has its stem attached. A temperature of 50° or slightly above is most conducive to keeping squashes for a long period.

1. Have you suitable conditions for the storage of squashes?
What are they? W-VG:429. C:417-419.

CHAPTER SIX

ROOT CROP PROJECTS

The root crops, including the beet, carrot, radish, turnip, parsnip, salsify, horse-radish, kohl-rabi, rutabaga, and celeriac, are grown with entire success at comparatively low temperatures, and they are generally cultivated throughout the North. They thrive best in moist, deep, fertile, sandy loams, but excellent roots are produced in a great diversity of soils. Sandy soils are favorable to their most symmetrical development, and there are fewer of the small, fibrous feeding roots, always objectionable, than when grown in heavy soils.

Project XII. Growing Root Crops

1. Importance of root crops.
2. Selecting location.
3. Choosing varieties.
4. Sources of seed.
5. Preparing the soil.
6. When to plant.
7. Spacing the rows.
8. Drilling the seed.
9. Companion cropping.
10. Thinning the plants.
11. Cultivating.
12. Weeding.
13. Combating insects.
14. Harvesting and marketing.
15. Storing root crops.
16. Forcing.

Though numerous questions are asked in the following project, very few page references are given, as it did not seem practicable to give the large number that would be required for the many vegetables of this group. Discussions of the various crops may be found in W-VG, L, and C, and also in bulletins.

1. Importance of root crops. — It is impossible to estimate the importance of the root crops. They are grown in practically all gardens, either for the home table or for commercial purposes. The great city markets are never without them and thousands of bushels are placed in storage every year. Most of the root crops are easy to grow and the ambitious gardener may have one or two members of this group for sale every month of the year. They offer splendid financial possibilities. This is especially true of the beet, carrot, radish, and turnip. The other members of the group can often be produced at a profit. The growing of one or more of the root crops may well have serious consideration as a home project. It is important, of course, to determine market needs, and to regulate the plantings accordingly.

1. What is the importance of the various root crops on your local market?
2. Will it pay you to grow any of the root crops? If so, which ones?
3. How generally are the root crops grown?
4. Name the root crops in order of their importance.
5. What is the history of each of the root crops?
6. What are the chief botanical characteristics of each member of this group?
7. Are the root crops "annuals" or "biennials"?

8. *How do the root crops differ in chemical composition?*
9. *How are the various root crops served on the table?*
10. *Are they essential in the diet, and how do they compare with the white potato in nutritive value? With the sweet potato?*



FIG. 43.—An excellent lot of turnip-shaped radishes.

2. Selecting location.—The root crops, as previously stated, thrive at comparatively low temperatures so that there is no part of the North where they cannot be successfully grown. By taking advantage of the cooler months they may also be grown with gratifying results in most parts of the South. In the North, the most important factor in seeking a location is the soil. A considerable proportion of sand is always an advantage. Root crops do best, too, in soils abounding in humus, for such soils are

generally moist and fertile. Stones or rubbish of any kind interfere in the operations of drilling, cultivating, and weeding. We should also avoid if possible locations containing large numbers of weed seeds, for these will be certain to add to the cost of production. It is essential, of course, that the land be well drained and it should be at least fairly level.

1. Describe the ideal location for the growing of root crops.

W : 180.

2. Do you have a suitable location for root crop production ?

3. What conditions should be avoided in the selection of a location ?

4. Do you know of market gardeners who grow large quantities of root crops? Describe their soils, and other cultural conditions.

3. Choosing varieties. — In the selection of varieties the following should have consideration :

Beet, early : Crosby's Egyptian, Eclipse, Early Model, Egyptian.

Beet, medium early : Detroit Dark Red, Edmonds Blood Turnip, Bastian Half Long.

Beet, late : Long Dark Red, Philadelphia Half Long.

Growers should also bear in mind that the turnip-shaped early varieties are extensively grown for winter use, but they are planted later than the strictly late varieties.

Carrot, early : Early Short Scarlet, Early Scarlet Horn.

Carrot, medium early : Chantenay, Danvers Half Long, Ox Heart, Rubicon.

Carrot, late : Long Orange, and Medium Early varieties planted later than late sorts.

Radish : Round Red Forcing, French Breakfast, Earliest White, Cardinal Globe, Crimson Giant, Chartier, White Icicle, Lady Finger.



FIG. 44.—Good specimens of oblong-shaped radishes which are in demand on many markets.

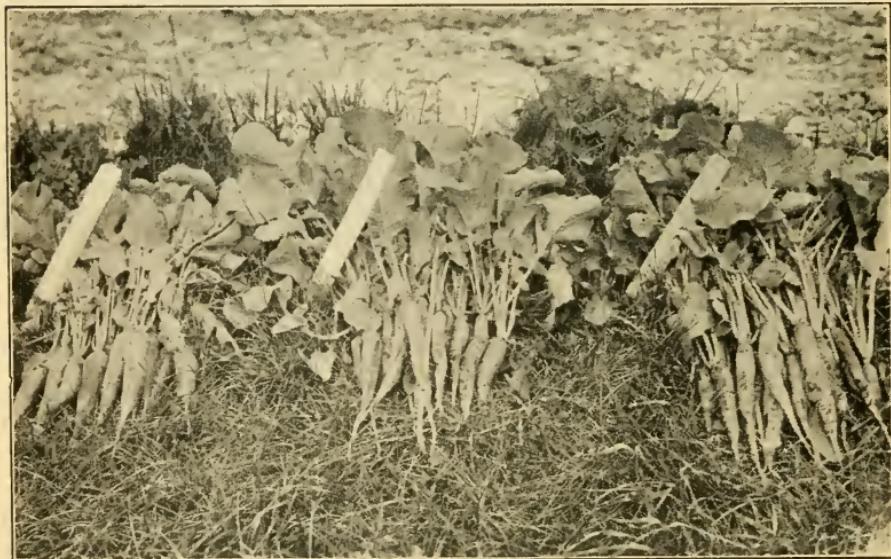


FIG. 45.—Long Cardinal radishes should not be planted in heavy soils.

Turnip: Purple Top Globe and Purple Top Strap Leaf.

Parsnip: Guernsey and Hollow Crown.

Salsify: Mammoth Sandwich Island, Long White, and Long Black.

Kohl-rabi: White Vienna and Purple Vienna.

1. What varieties of each class of the root crops would you select for early, medium, and late use?
2. How may the varieties of the various root crops be classified?
3. Make a thorough study of all the varieties that can be found in your community.

4. Sources of seed. — It is important to determine as far as possible the sources of the best strains of seed. There is a great difference in the quality of root crop seeds. Some growers attach so much importance to this matter that they grow and select their own seed. This is especially true of the beet. The roots desired for the production of seed are selected with extreme care so as to secure the greatest uniformity in size, shape, and color. They are then stored during the winter as explained in W:197 and planted early in the spring. Gardeners will find the growing of root crop seeds a most interesting proposition and it is well worth the attention of thoughtful students.

The principles involved in the production of garden seeds are discussed in W:43.

1. What may be said about the importance of obtaining superior root crop seeds?
2. Where can you obtain high-grade seed of the different kinds of root crops?

3. How much seed will you need for the various kinds of root crops?
4. How many years do the different root crop seeds retain their vitality?
5. Under what conditions should they be stored?



FIG. 46.—Early Model beets.

5. Preparing the soil.—In W:182 attention is called to the importance of the soil being well filled with organic matter, for soils deficient in humus never produce satisfactory root crops. The organic matter, too, must be well decayed. Fresh stable manures should never be employed in any considerable amount, for they encourage foliage development rather than root growth, while rotten manures have the opposite effect. The heaviest applications of composted or well-decayed manure may be made, thus increasing the size of the roots as well as their quality. If any coarse manure is to be used it should be plowed down, but

fine, decayed manure will be most beneficial if applied after plowing, and mixed thoroughly with the soil by harrowing.

Commercial fertilizers are widely used in the growing of root crops. It is customary to apply plenty of phosphorus. Potash is also regarded as an important factor by most growers. Nitrogen is essential, but its excessive use has the same effect as heavy applications of fresh stable manure. Ordinarily, at least half a ton of high-grade fertilizer to the acre may be used profitably.

The soil should be in a fine state of division before any seed is sown. (Students should look up W: 63 and all references.)

1. What kind and how much stable manure should be applied for the growing of root crops? W: 186.
2. When and how should the stable manure be applied? W: 186.
3. What would you recommend relative to the use of commercial fertilizer for the several root crops?
4. Make an estimate of your fertilizer needs, assuming that the materials are to be bought and mixed at home. What will the fertilizer cost per ton, mixed?
5. How should your soil be managed to have it in a thoroughly fine state of division for sowing the seed? W: 63.
6. Students will be interested in looking up the various methods employed by gardeners in the fertilizing of root crops.

6. **When to plant.** — The beet, carrot, radish, and turnip each may be planted in succession, if desired, as early as the soil can be prepared in the spring, until midsummer. The parsnip and salsify are long season crops and should be planted very early in the spring. Horse-radish roots should also be planted early in the spring.

1. When should the different root crops be planted?
2. What is the relation of varieties to the time of planting?

7. Spacing the rows. — When the root crops are to be cultivated with a hand wheel hoe, they are usually fourteen inches apart. Many growers prefer somewhat more space for the parsnip, carrot, and late beets. Radish rows may be closer together than any of the other root crops. An increasing number of gardeners prefer to allow about two feet between rows and then cultivate the crops with a horse. While the wider planting decreases the yield per acre it also reduces the labor bill and makes possible a larger area under cultivation with the labor available than when the work is done with hand wheel hoes.

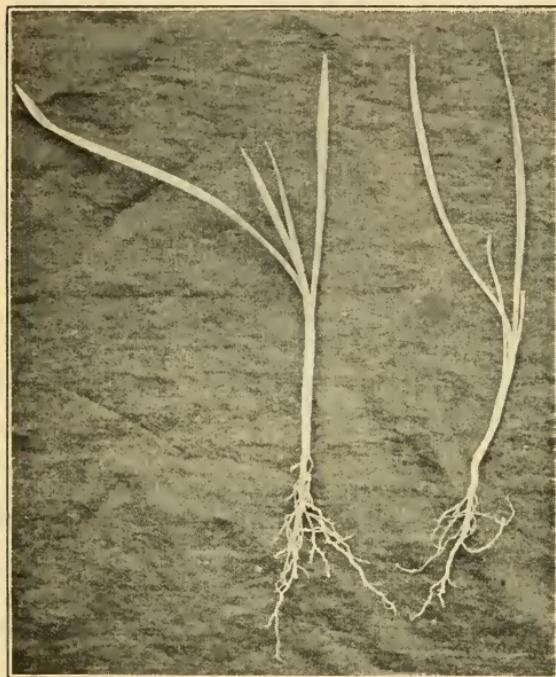


FIG. 47.—Salsify seedlings. Note on each plant the long roots with numerous laterals.

duces the labor bill and makes possible a larger area under cultivation with the labor available than when the work is done with hand wheel hoes.

1. How far apart should the rows of the different root crops be for wheel hoe tillage? For horse tillage? Which will pay you the best?

8. Drilling the seed. — Germination tests should be made of each kind of seed to be planted and the rate of sowing regulated accordingly. The tendency in sowing all of the root crops is to use too much seed, thus increasing the labor of thinning in order to avoid a harvest of small roots, due to the crowding of the plants. It is exceedingly important to drill just the right amount. The literature of root crop seeding should be carefully reviewed so that this serious mistake will not be made.

The depth of covering should be regulated by the kind of seed and by the character of the soil. Most of the seeds should be covered with about half an inch of fine, moist soil. Hand drills are essential in large market gardens, but in small gardens the seeds may be distributed rapidly in shallow furrows by the use of an envelope as explained in W:53. After the furrow has been closed with the back of a garden rake or other convenient tool, firming the soil with the hoe or with the feet brings the particles of moist soil into close contact with the seeds, thus causing them to



FIG. 48.—Good roots of salsify.

germinate more promptly and to give a larger percentage of germination.

1. What would you recommend in regard to germination tests of root crop seeds?
2. About how many seeds should be dropped to the linear foot of row for a good stand of each of the root crops?
3. What should be the depth of covering for the seeds of each of the root crops when planted in your particular soil?

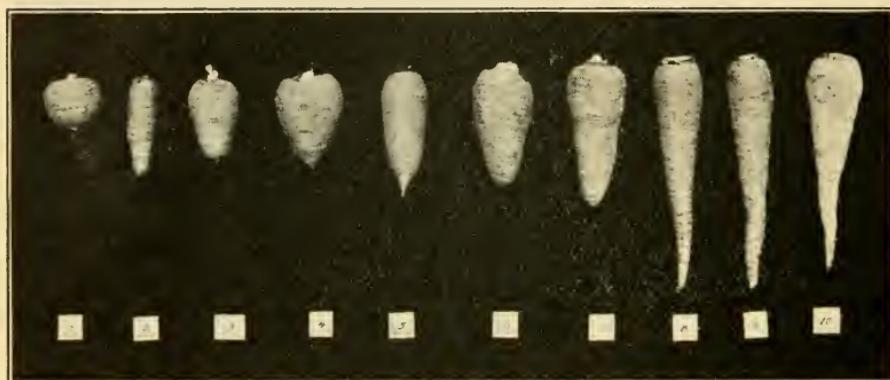


FIG. 49.—This illustration shows the various types of carrots, ranging from almost round to very long roots.

4. Explain the details of making the furrows, distributing the seed, closing the furrows, and firming the soil.
5. How will you make the rows perfectly straight and the inter-spaces uniform in width?
6. *What is the character of the mechanism of a good hand wheel drill?*
7. *Can you determine the relative cost of sowing an acre by hand versus with a wheel hoe?*

8. Do you recommend a combination drill and cultivator?
9. Would it pay you to own a drill? Why?
10. Does a drill do the work as well as it can be done by hand?

9. Companion cropping. — The root crops afford scores of opportunities for companion cropping. All sorts of combinations may be made within this group and also with many other vegetables. Students will find it interesting to work out different plans of companion cropping, including one or more with root crops. The following references will be found helpful: W-VG: 477, 478, 479, 480, 481, 487.

10. Thinning the plants. — Gardeners may be so skillful in regulating the rate of seeding that little if any thinning will be required. As a rule, however, some thinning is necessary. It should be done as promptly as possible, or before crowding has caused any of the plants to become spindling. The number of plants to each foot of row depends so much on the varieties selected and the size of the roots desired that it is impossible to give satisfactory general directions. Early button or turnip-shaped radishes may stand an inch apart; late ones, two inches or more; early beets, two or three inches; late varieties, four to six inches; early carrots, one to two inches; late ones, three to five inches,



FIG. 50.—Kohl-rabi must be grown rapidly and harvested promptly to secure the highest quality.

unless very small roots are wanted; early turnips, a couple of inches; late ones, four to six; parsnips, four to six; salsify, three to four.

Various kinds of small tools are available for thinning. It is often a matter of destroying whole clusters of surplus plants.

1. How far apart should the plants of early and late root crops stand in the row?

2. What is an effective method of thinning?

11. Cultivating. — Thorough tillage is a most important factor in the growing of root crops. Tillage should begin as soon as the rows can be seen and repeated as often as may be necessary until the roots are fully developed. Wheel hoes with various attachments are universally employed. They are great labor-saving implements and should be used instead of hand hoes whenever it is possible.

1. Describe the character of the cultivation required to grow good root crops. W: 186.

2. What tools are necessary?

3. Explain the uses of the various attachments of hand wheel hoes.

4. Explain the uses of the various types of hand hoes.

12. Weeding. — Even with the most thorough cultivation, more or less hand weeding is necessary in growing root crops. Various kinds of small tools, referred to in W: 305, are available to facilitate this work. It is necessarily a tedious and expensive operation, and should be reduced to a minimum by the proper use of cultivators.

1. What tools do you think you should have for weeding?

13. Combating insects and diseases. — Root crops are injured by insects that suck the leaf juices, eat the foliage, or mine the leaves or roots. Radishes destroyed by root maggots and flea beetles, or carrots injured by the carrot rust fly, are interesting examples. The spinach louse (spinach aphis) is a very common pest of truck crops, feeding generally on a number of different plants in the field, or in the greenhouses where it may pass the winter. The pinkish or pale yellow soft-bodied lice multiply very rapidly, sucking the plant juices, and when abundant causing the leaves to curl and dwarfing the roots. This insect is easily destroyed by spraying with a contact insecticide. On those crops where the leaves grow close to the ground some difficulty may be experienced in applying the spray. A spray boom devised for this purpose is very satisfactory in field practice.

Swarms of beet leaf hoppers often appear in fields of beets through large areas of many of the western states. Beet roots are subject to a disease known as curly top, which is transmitted by these insects as they migrate from one field to another. Curiously enough the hoppers which travel from a great distance are the most to be feared, as those which hibernate in near-by fields seldom do much damage. Injuries from the pests are apt to be periodical as they seem to avoid working in fields which were infested during the previous season. The insect



FIG. 51.—Swiss chard, botanically a beet which is most excellent for greens.

is single brooded. It inserts eggs into the thickened stem and larger leaf veins, and these hatch about fifteen days later, when the nymphs work into the heart of the plant. Little progress has been made in the control of the insect, and therefore of the disease.

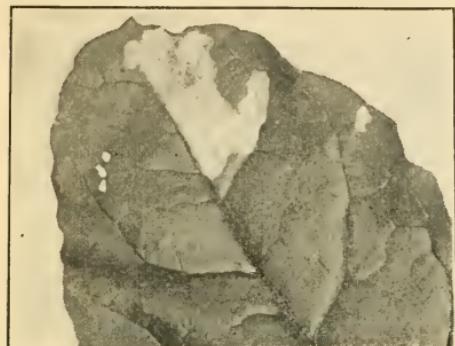


FIG. 52.—Spinach and beet leaf miner.

As a commercial practice, spraying appears to be unprofitable and of doubtful efficiency.

The common name "leaf miner" given to the spinach leaf miner describes the nature of its larval work. The larva eats into the tissue of the leaf, making a thread-like mine which by continued eating is

enlarged like a blotch. This leaf injury dwarfs the roots or spoils the leaves if used for greens. The adult fly, a two-winged fly, appears in the fields early in the spring and deposits eggs on one side of a leaf. These hatch, and the young larva, working in the leaf, becomes mature in about a week, when it deserts the leaf and enters the soil to pupate. Clean culture may be a means of control. There is no satisfactory remedy.

1. *Why is the spinach aphid such a serious pest?* CL: 105-106.
2. *What is its life history?* CL: 105-106.
3. *How can it be controlled?* CL: 107.
4. *Describe an improved type of sprayer.*
5. *How can radishes be protected from root maggots?* CL: 36.

6. *How does the work of the carrot rust fly on celery and on carrots differ?* CL: 153.
7. *What is the relation of curly top disease to leaf hopper attacks on beets?* CL: 93.
8. *Do hoppers from near-by fields endanger the crop?* CL: 93.
9. *What is the life history of the beet leaf hopper?* CL: 94.
10. *How does the insect feed?* CL: 94.
11. *What are some other insects injuring root crops?* CL: 90-107.
12. *What are the common and cultivated food plants of the spinach leaf miner?* CL: 90-91.
13. *What form of the insect causes the damage?* CL: 91-92.
14. *What is the nature of the injury?* CL: 91-92.
15. *What control measures are practiced?* CL: 92.

14. Harvesting and marketing. — Root crops are usually harvested as soon as they attain marketable size, for any considerable delay is certain to result in depreciation of the quality, the roots becoming pithy, tough, or fibrous. This is especially true of the radish. Even a few days may make a great difference in the quality of early radishes, for they soon attain an abnormal size, with accompanying pithiness or toughness, and a sharp, unpleasant flavor.

It is also exceedingly important to sell early beets while they are tender and succulent, and, though small in size, they may command better prices than if allowed to grow for several weeks

longer. The same may be said of early turnips, carrots, and kohl-rabi, the latter crop having an enlarged stem rather than an edible root, although often classed as a root crop.

Parsnips and salsify are extremely hardy roots and are seldom injured by the severest winter temperatures, especially if the ground is well covered with snow. While they may be dug in the fall and stored for winter use, and it is desirable to harvest some

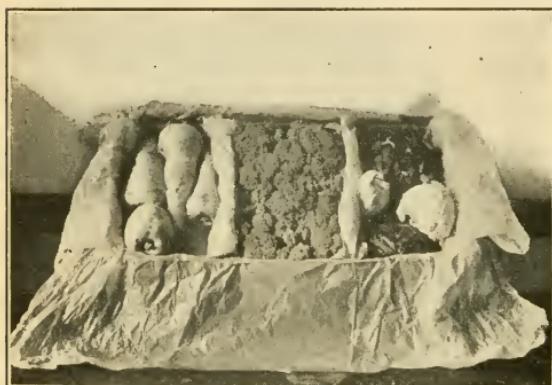
of the roots for this purpose, the usual custom is to leave most of the roots in the ground until spring.

Late beets, carrots, and turnips should be harvested in the fall before there is hard freezing weather and placed in storage (W: 197). Though

FIG. 53.—Home hampers are very useful for the selling of parsnips, parsley, and various other vegetables.

beets with their tops on are sometimes kept in trenches during the early winter and sold as "bunch beets," the usual custom is to cut off the tops of all late root crops before burying them or placing them in other storage.

Early beets, radishes, and carrots are generally sold in bunches, the number per bunch varying according to the market requirements. Before deciding upon any given number per bunch, the markets to be supplied should be investigated, which should be a guide to all marketing preparations. The roots are generally washed after they have been tied into bunches. If the roots are very attractive it may pay to use fancy tying material such as blue and red tape, about $\frac{1}{4}$ inch wide, now sold by garden supply houses.



1. At what stage of development should root crops be harvested?
2. Why is it important to harvest early root crops as promptly as possible?
3. Which of the root crops may be left in the ground all winter?
4. How should early root crops be prepared for market? Late root crops?
5. Can you suggest any improvement in the methods employed in marketing root crops in your community?

15. Storing root crops. — Millions of bushels of root crops are stored every year. The number of permanent storage pits and houses is constantly increasing. Some of the pits are very simple and inexpensive to construct. They are often built of concrete and covered with enough soil or litter of some kind to prevent the roots from freezing. Plans for such pits or houses may be obtained from most of the agricultural colleges.

The home project gardener, however, may not have such a pit, and he may not have the means to construct one for the first crop or two. In that event, he can bury the roots so that they will keep in perfect condition. A well-drained location should be found. The roots, such as beets, carrots, turnips, parsnips, and salsify, may be piled on top of the ground, or if the drainage is good, an excavation eight to ten inches in depth may be made. In either case the roots should be first covered with four to six inches of straw and then several inches of soil, and as the winter comes on soil applied to depth of one foot, with enough horse manure to protect the roots from freezing. In most parts of the North a covering of manure half a foot deep on top of the soil will be necessary to insure the safety of the roots. The pit may be opened on mild days during the winter to remove all or part of

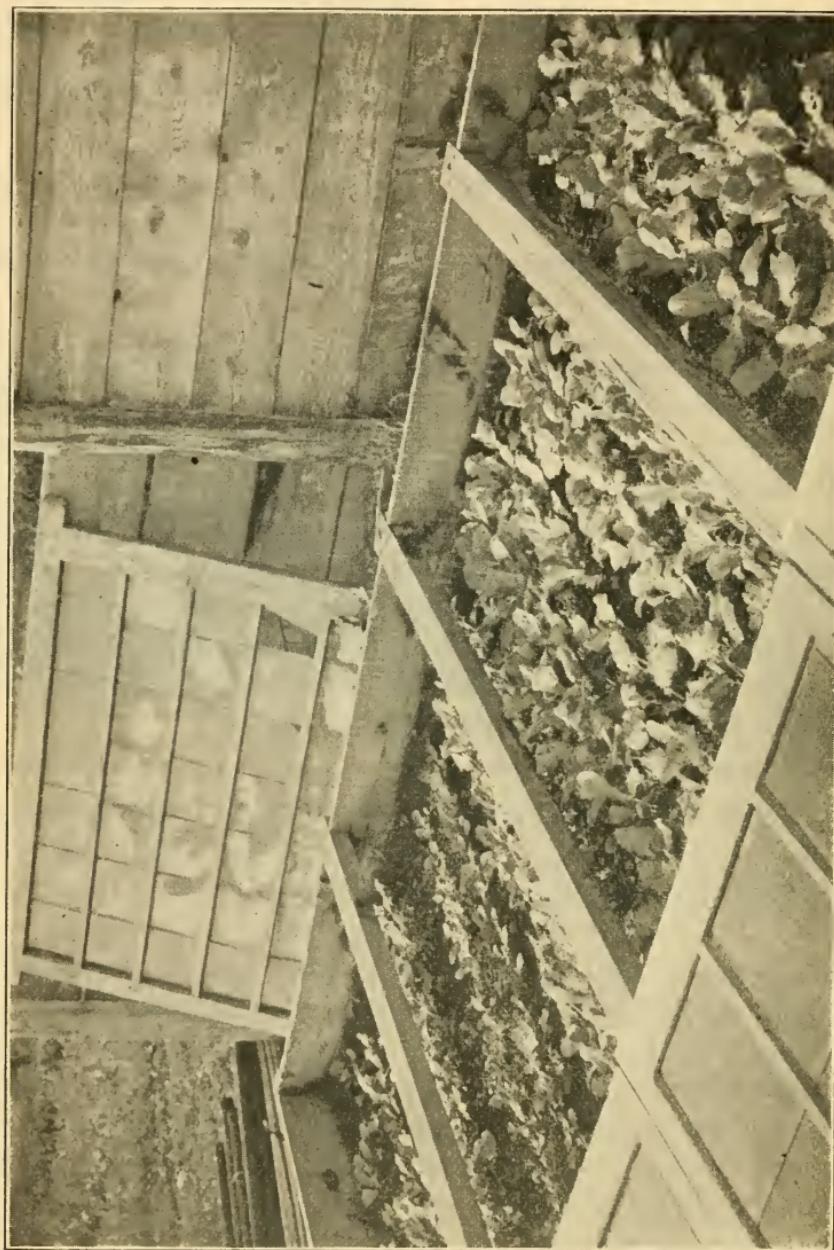


FIG. 54.—A forcing crop of vegetables in cold frames.

the roots, or it may remain undisturbed until some time in March. The roots should be in perfect condition when taken from the pit.

1. What are the most favorable conditions for the storage of root crops?
2. What are the best directions for burying root crops?
3. Make plans for a simple concrete storage pit that would hold 50 to 100 bushels of roots. What would it cost? Could you build it?
4. Will it pay you to store root crops for winter and spring sales? Why or why not?

What prices do root crops generally command on your local markets?

16. Forcing.—Carrots are grown to some extent in cold frames, and radishes are largely grown both in frames and in greenhouses. The soil should be prepared with great care. The rows are generally much closer together than in out-of-door plantations, for it is not uncommon to make them only four or five inches apart.

Radish forcing is fully discussed in W-VF: 246-259, 387-406.

CHAPTER SEVEN

TUBER CROP PROJECTS

Potatoes and sweet potatoes comprise the tuber crop group. They are so different in soil and climatic requirements that comparatively few instructions relating to their culture apply equally well to both vegetables. Sweet potatoes grow best in sandy soils and in the warm climates with long seasons, while the potato produces the most satisfactory crops in sandy loams or in other types of soils which do not become too compact, and in climates which are fairly cool.

Project XIII. Growing Potatoes

The potato belongs to the potato family. Another important commercial plant belonging to this family is the tomato. Closely related, although quite different plants, are the common or black nightshade and the bittersweet. The potato is a native of South America, where it was doubtless first cultivated by the people of Chili and Peru. Unlike the tomato the potato grows best in a cool, moist climate. This fact can be appreciated when it is known that our best potato-producing regions in the United States are our northernmost states.

The roots of the potato plant are fine and fibrous. The "potatoes," or as they are properly known, tubers, are often considered a part of the root system but they are in reality underground stems. These underground stems grow out to a length of three or four inches from the main axis or stem and their tips become swollen to form the tubers. The fact that the tubers are modified stems is

evidenced by the eyes, which are rudimentary buds. True roots do not have buds. Sometimes tubers form in the axils of the leaves above ground, and only stems or shoots could grow in such a location. The formation of tubers above ground is usually an indication of the presence of a fungous disease, but it is a proof of the true nature of the tuber.

The stems which bear the leaves are of the ordinary kind and are usually smooth at first, but they develop ribs as they grow older. The leaves may be simple when first developed, but they become compound. The leaves of the different varieties vary considerably in appearance. The flowers of the potato are regular and vary from white to yellow, purple, or blue. Some varieties seldom bloom and even when flowers are produced the fruits are only rarely developed. The fruit is a globoid berry resembling a very small tomato, and is called by different names, the most common being "potato ball" or "seed ball." The seeds are small and numerous. Potatoes are rarely propagated by seed except by plant breeders who desire to cross or improve varieties. Every one is familiar with the common method of propagation by tubers. We are so accustomed to propagating plants by seed that the expressions "seed tubers" or "seed potatoes" are only natural, but we must keep in mind that the tubers are not seeds.

1. *Where was the potato first cultivated?*
2. *Under what conditions does the potato thrive best?*
3. *What part of a plant is a tuber?*
4. *What is the nature of a healthy potato leaf?*
5. *What conditions of the leaves indicate diseases?*

6. *Does the blooming of potato plants necessarily have any connection with the production of tubers?*
7. *What are "potato balls" or "seed balls"?*
8. *For what purpose may potato balls be propagated by real seeds?*
9. *What is the usual method of potato propagation?*

Project Outline

1. Why grow potatoes?
2. Selecting location.
3. Choosing varieties.
4. Obtaining seed.
5. Preparing the soil.
6. When to plant.
7. Cutting the tubers.
8. Planting.
9. Cultivating.
10. Combating insects and diseases.
11. Harvesting.
12. Storing and marketing.

1. Why grow potatoes? — The potato is one of the most important food crops of the United States. It is grown in all parts of the country and is consumed in large amounts by practically all classes of people. Good local markets for this crop may be found in almost every county. As a business proposition the culture of the potato deserves careful consideration. The crop is not difficult to grow, and it offers special inducements to those who understand and apply the principles relating to its culture.

It is estimated that the average annual world crop of potatoes is about 5,000,000,000 bushels, 90% of which is grown in Europe.

The growing of potatoes fits well into the various rotations of general farm crops. It is an excellent crop to follow clover and provides a cash return that makes it peculiarly attractive to thousands of farmers. For example, in a survey in Chester County, Pennsylvania, potato plantings were found on 366 of 378 farms investigated.

1. How generally is the potato grown in the United States? Gi: 5-13.
2. Do you think it would pay you to make potato culture a home project? If so, why?
3. What is known about the history of the potato? Gi: 14-20.
4. To what extent is the potato grown in other countries? Gi: 1-13.
5. What are the uses of the potato? Gi: 259-284.
6. How does the potato compare with the root crops in composition and food value? Fr: 166-170.
7. Discuss the various ways of serving potatoes.

2. Selecting location. — As previously indicated the potato is best adapted to a cool, moist climate. It is largely for this reason that European yields exceed the crops obtained in the United States. The average yield for the United States in 1914 was 96 bushels to the acre, while for the same year it was 130 for France, 311 for the Netherlands, 388 for Belgium, 210 for Great Britain, and 200 for Germany.

In this connection we should not lose sight of the fact that far more intensive methods are employed in Europe, so that the larger yields obtained there are not wholly attributable to more favorable climatic conditions.

Even in the northern half of the United States, the summers are too hot for the best results with potatoes. Many growers, however, are able to provide and maintain such favorable soil and cultural conditions that heavy crops of potatoes are grown year after year in spite of our comparatively long, hot summers.

Heavy, compact soils should always be avoided, if possible, in selecting a location for the potato. Sandy soils are employed largely in southern districts because they produce a very early crop, but they are not adapted to the late crop because of their deficiency in moisture. In most of the important potato growing districts of the North the soils vary from sandy loams to gravelly loams. Whatever the type, it should be loose and friable. The clay and silt soils are not so favorable to the production of a large crop of good tubers, and when it is necessary to use such soils they should be supplied with a large amount of organic matter.

The summer rainfall of the United States is also generally insufficient for a maximum yield of potatoes, so that naturally moist but well-drained soils should be selected for this crop.

1. Do you have a suitable location for growing potatoes?
2. What kind of soil should be selected for this crop?
Gi: 86-112. Fr: 17-25.
3. What are the soil moisture requirements for potatoes?
Gi: 92. Fr: 8.
4. How do the European climates compare with that of the United States in their adaptation to potato culture?
Gi: 87.
5. What do you know about the soil and climate of Aroostook County, Maine, where potatoes are grown so extensively?

3. Choosing varieties. — In the choosing of varieties, a number of factors should be considered, the following being the most important: (1) *Quality*. Consumers are demanding quality. They want tubers that are mealy, not soggy, when boiled, and that are also mild in flavor. (2) *Yield*. Some varieties produce much heavier crops than others. Early varieties do not yield so well as late ones. As a rule the tendency is to sacrifice quality for quantity, and this tendency is unfortunate because consumers are generally willing to pay a good price for potatoes of high quality. (3) *Shape*. The flat-round and oval tubers are the most popular shapes. Deep and numerous eyes are objectionable. (4) *Disease resistance*. Some varieties are more resistant to disease than others, and they are also more vigorous in growth.

Among the early varieties, Early Ohio and Irish Cobbler are very popular, the former being of high quality. Popular late varieties are Green Mountain, Rural New Yorker, Carman No. 1, Carman No. 3, Sir Walter Raleigh, and Heath's Late Beauty.

An excellent plan is to consult your dealer and your neighbor farmers before making a final decision concerning varieties which will pay best on your particular soil and market. It is also exceedingly important to select varieties with special references to disease resistance as, for example, the dreaded potato wart disease.

- 1. What factors should have consideration when choosing varieties of potatoes to be planted?**

Fr: 71-86.

- 2. What are the leading early varieties, and which one will be likely to pay you best?**

Fr: 87-90.

- 3. What are some of the leading late varieties, and which will pay you best?**

Fr: 87-90.

4. **What special preference has your market?**
5. *How can you determine the quality of a variety?* Fr: 72-74.
6. *What can be said about the starch content of potatoes?*
Fr: 72-74. Gi: 265, 270.
7. *How may varieties be classified?* Gi: 21-46.
8. *How does the character of the soil affect the quality of the tubers?*

4. Obtaining seed. — Large yields of potatoes cannot be obtained without the use of good seed. By good seed is meant solid, dormant, disease-free tubers, selected from high yielding plants. It is not often possible to buy seed that is satisfactory in all these respects, especially with reference to high yielding plants. This point, however, should have consideration in the home project, if potatoes are to be grown the following year. Numerous experiments have shown that it pays to select seed from healthy plants producing heavy crops of large, smooth tubers. This is a matter which requires considerable time, but it is time profitably spent.

When it is necessary to purchase seed, extreme care should be exercised. A common practice is to plant seed grown in a more northern section, but such seed has little if any advantage over home-grown seed provided the latter is produced intelligently and stored under the most favorable conditions. If the tubers are allowed to wither and produce long sprouts before they are planted, satisfactory results cannot be expected.

1. **How and where can you obtain good seed?** Fr: 51.
2. **What constitutes good seed?**

3. How should seed be stored to keep in good condition?

Fr: 53-54.

4. Has northern-grown seed any advantages over home-grown?

Fr: 51.

5. How would you proceed to select your own seed?

Fr: 74. Gi: 54-85.

5. Preparing the soil (W: 63-204). — When making preparation for a successful crop of potatoes, we should bear in mind that much will depend on our skill in controlling soil moisture. We have learned that this crop must have a large amount of water if a satisfactory yield is to be expected, and the soil management should be such as will conserve as much moisture as possible for the benefit of the potatoes.

Potatoes are nearly always grown in rotation with other crops. On Long Island and in a few other sections they are grown on the same soil year after year, but the practice should not be recommended. In general farming regions red clover or grass of some kind nearly always precedes potatoes. Probably no crop is better for this purpose than red clover because it leaves the soil in a loose, friable condition and makes large contributions to the soil supply of nitrogen and organic matter.

Stable manures are very generally used for the growing of potatoes, and the amount varies from 10 to 25 tons to the acre. It is doubtful whether the very large applications of manure are as profitable as smaller amounts — 10 to 15 tons — supplemented with commercial fertilizers. The manure, too, should be at least partially decayed, and, if possible, it should be applied in the fall before the land is plowed.

Fall plowing is always an advantage from the standpoint of soil moisture, if the land is harrowed just as early in the spring as

it is dry enough to work. Not a day nor an hour should be lost in harrowing, in order that the escape of moisture from surface evaporation may be reduced to a minimum. A fine soil mulch should be maintained by harrowing until the potatoes are planted, and then weeders and cultivators should be used for the same purpose.

There is a very great difference in practices relative to the use of commercial fertilizers for potatoes. The growers of early potatoes on light sandy soils used an immense quantity of high-grade complete fertilizer before the World War. It was not uncommon to apply a ton of fertilizer to the acre, which contained 4 to 6 per cent of nitrogen and 8 to 10 per cent of each of the mineral elements.

When a clover sod or other leguminous crop is plowed down for late potatoes it is unnecessary to use as much nitrogen as for the early crop, especially in light soils. Under most conditions in the North, it is likely that 2 or 3 per cent of available nitrogen in a 1000 pound application to the acre will furnish as much nitrogen, in addition to the nitrogen of the legume plowed down, as will be required to secure a satisfactory growth of plants. It is admitted by most growers that liberal amounts of the mineral elements are essential, though very large crops were grown during the war without applications of potash. Ordinarily, about 150 pounds of nitrate of soda, 500 pounds of 16% acid phosphate, and 300 pounds of muriate of potash, used as a supplement to stable manure, or after a clover sod is plowed down, will give good results, if other conditions are favorable. The fertilizer, however, should not be applied until spring, when the land is harrowed. If the plowing is not done in the fall, it should have the earliest attention in the spring.

Inasmuch as fresh lime encourages the development of scab on potatoes, the liming should be done in connection with other crops, preferably the cereal which precedes the clover.

1. What are some satisfactory crops to precede potatoes? Why do you think they are desirable?
Fr: 26-29.
2. Should stable manure be used for potatoes? If so, what kind? How much? When applied?
Fr: 30, 36-39. Gi: 130.
3. When should land be plowed for this crop? When should it be harrowed?
4. Should commercial fertilizers be employed for potatoes? Make specific recommendations for various conditions.
Fr: 30-50. Gi: 113-132.
5. What kinds and how much fertilizer will you need for your potato project?
Gi: 112-132.
6. What should be the texture and structure of soils for the growing of this crop?
7. What are the functions of nitrogen, potassium, and phosphorus in the growing of potatoes? Fr: 31-36. Gi: 119-126.
8. Should lime be used for potatoes? If so, what kind, how much, and when applied? Gi: 124.
9. Ascertain the character of the fertilizer treatments generally employed in the leading potato growing districts of the United States and Canada. In European countries.
10. What lessons do the agricultural experiment stations teach on fertilizer treatments?

6. When to plant. — Very early potatoes are generally planted about as soon as the ground can be prepared in the spring. Late

potatoes are planted in most northern sections from about the middle of May until the middle of June, or even later sometimes. Perhaps the safest guide as to the time of planting is to make inquiry among local growers. Most farm communities have one or more highly successful potato growers and their judgment in this matter should be a safe guide.

1. When do you think potatoes should be planted in your community? What are your reasons for selecting a certain time?
2. When are potatoes planted in the leading potato-growing districts of the United States and Canada? Fr: 96. Gi: 142-146.
3. What factors should be considered in deciding on the date of planting? Fr: 97. Gi: 142-146.

7. Cutting seed. — Yields are reduced by cutting the seed several days or more in advance of planting. It is always best to cut the seed the same day it is planted, or at most not more than twenty-four hours before the cut pieces will be planted.

Numerous experiments have been made to determine the best size of the pieces. This depends upon a number of factors such as the amount of seed available, cost of seed, fertility of the soil, variety to be planted, culture given, and the probable price that will be realized for the crop. Generally speaking, the pieces should be fairly large and should contain at least one good eye; two are better. In very rich garden soils the pieces need not be so large as in poorer soils. It is desirable when possible to cut the tubers so that one or more eyes at the stem end of the tuber will be included in the piece. Some tubers should be halved through the center of the group of eyes at the seed end. Larger tubers may be quartered from end to end, while others will make three good pieces. If the pieces are fairly large and contain at least one good

eye, they should give satisfactory results, other conditions being favorable.

From eleven to twelve bushels of seed to the acre are generally planted in America, though many prominent growers use a larger amount.

1. **What are the factors that should be considered in determining the size of seed pieces?** Fr: 60-62. Gi: 156.
2. **How many eyes should the pieces contain?**
Fr: 60-62. Gi: 157-159.
3. **Explain how the tubers should be cut.** Fr: 61. Gi: 157-159.
4. **How many bushels will you need for your project?** Gi: 159.
5. **Does it pay to sprout potatoes before they are planted?** Fr: 54-59.
6. **What are some of the lessons taught by the agricultural experiment stations relating to the cutting of seed potatoes?**
Fr: 57-69.

8. Planting. — The soil should be in a fine state of division before starting to plant potatoes. Most American potato growers space the rows 30 to 36 inches apart, the closer spacing being favorable to the largest yield. In small gardens which are cultivated with wheel hoes, the rows, especially of early varieties, need not be more than 26 inches apart. Though potatoes are sometimes planted in hills, the more common practice is to distribute the pieces 12 to 14 inches apart in drills. This gives each plant the best opportunity for development and the plan is the most favorable for large yields.

The proper depth of planting is a matter which should have the most careful consideration. In light, friable soils it is universally conceded that the seed should be planted about four inches deep, because this depth of planting is most advantageous from the

standpoint of soil moisture and low temperature for the roots. In heavy soils the depth of planting should be less, and then ridging may be practiced about midsummer so as to provide sufficient soil for the development of the tubers.

1. What are the proper distances for the planting of potatoes?

Fr: 91-93. Gi: 146-148.

2. How deep should potatoes be planted in different types of soils?

Fr: 93-96.

3. Describe the mechanism and advantages of an approved potato planter. Fr: 98-104.

9. Cultivating. — The potato requires just as thorough cultivation as any other garden crop. The surface of the soil must be kept in a fine, loose condition.

Weeders should be used immediately after planting until the plants are at least six inches high, and then various types of cultivators may be employed. If the cultivating is skillfully managed, very few weeds will have a chance to grow to any considerable size.

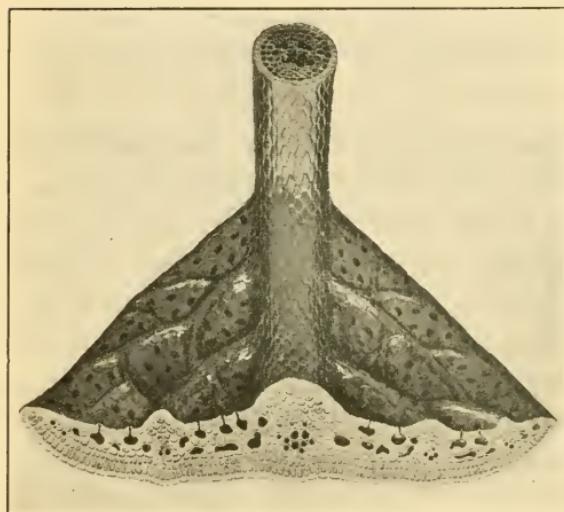


FIG. 55.—This illustration shows the potato leaf in cross section, also a portion of the lower surface. Note the vascular arrangement, also the large air spaces, and stomata ("breathing spores"). A film of the proper material protects this potato leaf.

1. What implements will you need to cultivate your potatoes?

Fr: 107-110. Gi: 160-169.

2. Give complete instructions for the season's tillage operations.

Fr: 105-110. Gi: 160-169.

10. Combating insects and diseases. — It is impossible to produce a good crop of potatoes without the proper control of disease and insect enemies. Apparently a large percentage of commercial growers do not fully appreciate this factor in the successful production of potatoes.

If we fully realized the function of perfect, healthy foliage in the growing of large tubers, more attention would be given to protecting the leaves against the attack of both insects and diseases. Let us remember that the leaves are the great laboratories of the plant and that the tubers cannot develop without them. The elements which enter the plant through the roots and leaves are combined into starch in the leaves and then transported through the stem and stored in the form of tubers. It is readily seen, therefore, that any curtailment in leaf surface, due to the ravages of insects and diseases, will certainly limit the plant in its ability to produce starch and tubers. If there is only half a crop of leaves we cannot expect more than half a crop of tubers, while a full crop of leaves, accompanied by favorable cultural conditions, should result in a full crop of tubers. The problem, then, is how to save all the leaves in a perfect state of health.

Insects and diseases affecting the foliage may be controlled by spraying. The first applications should be made before the enemies appear, and this means soon after the plants are up. Flea beetles may be the first to arrive and Bordeaux mixture will repel them. Additional applications should be made as often as may be necessary to keep the leaves well protected.

Both the upper and lower surfaces of the leaves must be

thoroughly covered with the spray material. A film is all that is needed. What runs off is wasted. The manner of applying the material will determine most often the success or failure of the enterprise. A potato grower can get good results with an atomizer or knapsack type of outfit if he takes the pains. The trouble is that it is neither efficient nor economical. Most growers are



FIG. 56.—A spraying machine doing effective work. High pressure (200 pounds), proper nozzle adjustment, and plenty of material (100 gallons to the acre).

not willing to carry out and apply by hand one hundred gallons of Bordeaux mixture, per acre, per application. The most economical control of the foliage diseases is accomplished by high pressure and plenty of material.

Bordeaux mixture is generally employed to control diseases and is easy to make either by the gallon or by the hundred gallons. All it requires is (*a*) copper sulphate (blue stone), (*b*) stone lime, caustic lime (lump lime), and (*c*) water. Place two 50-gallon

barrels beside the water supply. No location is better than right on the bank of a running stream or pond. Weigh 50 pounds of copper sulphate in a burlap sack and fasten as near to the top of one of the barrels as possible. This is accomplished easily by pulling the top of the sack over the edge of the barrel and nailing. Then

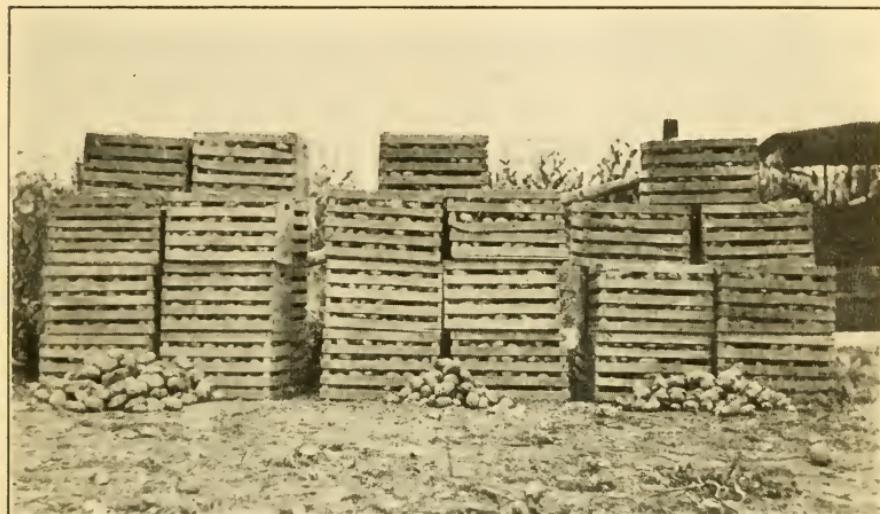


FIG. 57.—Potatoes: Middle lot, unsprayed (same areas in each case); to the left, sprayed (71 bushels per acre); to the right, low pressure sprinkling (30 bushels' increase per acre).

fill the barrel with water. The above operation should be done a few hours at least before the spraying begins, so that the copper sulphate may have time to dissolve. Do not put the copper sulphate into the bottom of the barrel and expect it to dissolve. Dump 50 pounds of stone lime into the other barrel, and add water, slowly at first, sprinkling evenly over the lime, and as the chunks begin to dry, add a little more until a vigorous heat begins to generate. Then add the water rapidly enough to prevent the formation of dust, but slowly enough to keep it the consistency of thick mud. Let it cook until when stirred from one side to the other it is as smooth as butter and of about the same consistency.

Then fill the barrel with water. You now have 50 pounds of copper sulphate in 50 gallons of water, and 50 pounds of lime in 50 gallons of water. This will make 625 gallons of Bordeaux mixture and is enough to spray six acres once. The remainder of the operation is also quite simple. Place the spray rig most conveniently for filling. Fill about one third full of water and add (assuming that the tank holds 100 gallons) 8 gallons from the lime barrel. Stir well. Then add more water until the tank is about three quarters full, and add 8 gallons, well stirred, from the copper sulphate barrel, and fill the rest of the way full with water. The tank now contains 100 gallons of Bordeaux mixture of the standard 4-4-5 formula or 8-8-100, costing 80 cents. The whole operation takes about 30 minutes. It makes spraying a one-man job. There is no mixing and stirring to get the material into the tank, and there is no clogging of nozzles. Spraying with Bordeaux controls the foliage diseases known as late blight and early blight. The Bordeaux mixture never burns the foliage and is a splendid carrier of insecticides, such as Paris green, the arsenicals, and nicotine. Many times spraying with Bordeaux results in an increased crop even when diseases are not present to any extent.

Rolling of the leaves, a curly appearance, deformation of the leaves, or a dwarfed condition of the plant, are evidences of diseases known as leaf-roll and mosaic. Such diseases are transmitted from one generation to another by the tubers, and when they make their appearance care must be taken in the selection of seed tubers.

The tubers are often disfigured by scab, which may be prevented by treating the seed potatoes with a formaldehyde solution (1 pint to 30 gallons of water) for an hour and a half.

1. What is the function of foliage in growing a crop of potatoes?

2. When should potatoes be sprayed?
3. What kind of sprayer would you select?
4. How should the spray material be applied?
5. What do you recommend for combating diseases of potatoes?
Insect enemies?
6. How should the spray material be prepared?

The potato flea beetle, which is also common on tomato plants, retards the growth of potato plants because it feeds on the first unfolding leaves, and especially on earlier varieties where it causes extensive reductions in the number of tubers.

The Colorado potato beetle, originally feeding on the Buffalo Bur, *Solarium rostratum*, west of the Missouri River, has spread across the country more rapidly than any other pest of late years. The beetle passes the winter as an adult under rubbish or in the soil. Just about the time early planted potatoes appear, the beetles emerge, feed on the tender foliage, and then lay their orange yellow eggs on the under side of the leaves. The dark red black-headed grubs hatch in four to nine days, and when mature enter the soil to pupate. The adults emerge about five or ten days later. After feeding for a short time they may go into the ground for a resting period, or lay eggs for a second generation. Normally all stages may be found throughout the summer. Arsenical poisons are effective control measures, especially if applied as soon as the grubs hatch. Although a slower poison than other compounds, arsenate of lead is being more generally used, because it seldom injures the foliage. Four or five pounds of lead arsenate are used to each acre to be sprayed. One hundred gallons of spray will be sufficient to cover an acre of potatoes.

While the potato aphid is generally prevalent, few areas have reported outbreaks. In certain regions it causes severe damage, sucking the plant juices, and wilting the plant. Leaves when attacked curl downward, the blossoms are killed, and the tubers dwarfed.

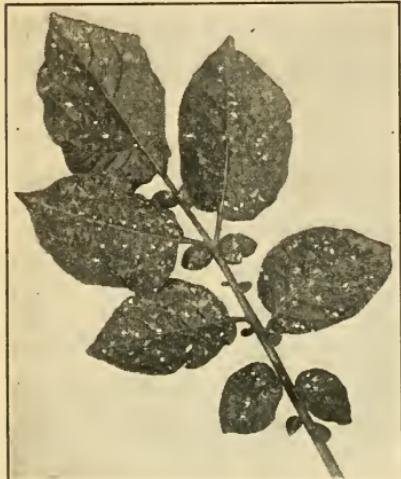


FIG. 58.—Potato flea-beetle injuries.

The lice are usually of a green color, but some individuals are pink. Eggs are laid on roses or other perennials in the fall, but do not hatch until the following spring. The stem-mothers and their progeny live on these plants for one or two generations, and then migrate to potatoes to breed until the approach of winter when sexual forms migrate to the rose. Spraying with Black Leaf 40, $\frac{1}{2}$ pint to 50 gallons of Bordeaux mixture, or with the same amount of Black

Leaf 40 and water to which 3 or 4 pounds of dissolved soap have been added, may be effective. At least 100 gallons of the mixture are required to cover an acre, the spray being directed upward by angle nozzles, so as to drench the under side of the foliage.

1. *What is the cause of "pimply" potatoes?* CL : 316.
2. *Is control practical in large potato fields?* CL : 317.
3. *What are some other flea beetles on general crops?* CL : 318-337.
4. *What is the life history of the Colorado potato beetle?*
CL : 145-146.
5. *Summarize briefly its migration across the United States.*
CL : 142-144.

6. *Name several arsenical poisons and describe their use on potatoes.*
CL : 147-148.
7. *When should the spray be applied?* CL : 148.
8. *What is another common potato beetle?* CL : 149.
9. *What are the host plants of the potato aphis?* CL : 151.
10. *What is its life history?* CL : 151-152.
11. *Describe the appearance of an injured plant.* CL : 152.
12. *How should potato vines be sprayed for aphis, and with what material?* CL : 153.
13. *Name other serious pests of white potatoes.* CL : 155-167.

11. Harvesting. — Early potatoes may be dug whenever they have attained a marketable size, though it may be profitable to let them grow to full maturity. This will depend mainly on market prices. Late potatoes, unless there is an unusual demand, should not be dug until the tops are practically dead or there is danger of the tubers freezing in the ground. As long as the tops are green, starch will be formed and stored in the tubers, thus improving their quality.

A great variety of tools are used for digging potatoes. If nothing else is available, an ordinary mold-board plow may be employed, followed by a spike-tooth harrow. The various types of special diggers are generally regarded as great labor-savers.

1. *When should early potatoes be dug? Late potatoes?*
Fr : 143. Gi : 226-230.

2. *What are some of the best tools for digging potatoes?*
Fr : 143-146. Gi : 230-232.

12. Storing and marketing. — A fairly moist atmosphere and a temperature of 33° F. are most favorable for the storage of potatoes. The tubers are easily injured by frost, and they soon shrivel and become inferior in quality when kept in dry, warm rooms. Moist cellars and caves furnish the best conditions for the storage of this crop.

The grading of potatoes is becoming more popular, and it may be the means of materially increasing the returns per acre. Crates, barrels, baskets, and sacks are used in the marketing of this crop.

1. What are the most favorable conditions for the storage of potatoes? Fr: 147-152. Gi: 236-258.
2. Do you have suitable storage facilities for this crop?
3. How will it pay you best to market your crop?

Project XIV. Growing Sweet Potatoes

The sweet potato belongs to the Morning Glory family. There are several other species here of economic importance, wild sweet potato vine and the bindweeds as weeds, and moon-flowers and morning glory as ornamentals. The family has a wide distribution but is most abundant in the tropics. The sweet potato is a native of the West Indies and Central America. This accounts for the fact that it does best in a warm climate.

The sweet potato plant is a trailing, twining, perennial plant, *i.e.*, lives year after year. The enlarged underground parts are sometimes called "tubers" or "root tubers" but they are in reality roots and not genuine tubers as in the Irish potato. The leaves are arranged alternately on the stems and are heart-shaped in general outline. The flowers are large, funnel-form in shape, and purple in color. There are several types or varieties of sweet potatoes. The varieties differ somewhat in the shape and size of the roots

or potatoes and also in the outline of the leaves, but the most common method of dividing them into groups is on the basis of the amount of water and sugar present in the potatoes. The ones with a dry, mealy, yellow flesh are usually called sweet potatoes and are mostly used in the northern states. In this class belongs the Jersey sweet potato, in which the roots are spindle-shaped. The so-called *yams* have a watery flesh, are sweeter, and are soft and jelly-like when cooked. These are most used in the southern states. They should not be confused with genuine *yams*, which belong to another family, closely related to the lily family. Several species of insects, such as tortoise beetles, flea beetles, or the sweet potato weevil, occasionally harm this crop, but the injury, except from weevil, is usually not extensive.

1. What are some of the close relatives of the sweet potato?
2. What is the nature of the part of the plant called the "potato"?
3. How do so-called *yams* differ from ordinary sweet potatoes?
4. What insects affect the sweet potato?

Project Outline

1. Why grow sweet potatoes?
2. Selecting location.
3. Choosing varieties.
4. Obtaining seed.
5. Starting plants.
6. Preparing soil.
7. Planting.
8. Cultivating.
9. Harvesting.
10. Storing and marketing.

1. Why grow sweet potatoes? — In most parts of the North, gardeners who are looking for real business opportunities will not attempt the culture of sweet potatoes. However, there are sections along the Atlantic Coast, especially in New Jersey, as well as in the Central West, where the crop is highly profitable, and where it deserves serious consideration as a business proposition. Students are referred to the literature on the subject, which is excellent and quite extensive. If soil and climatic conditions are favorable, and sweet potatoes of the highest quality can be grown, the crop may offer just as great inducements as any other vegetable.

- 1. Will it pay you to grow sweet potatoes?**
- 2. Are sweet potatoes produced at a profit in your neighborhood?**
- 3. What is known about the botanical history of the sweet potato?**
W-VG : 435. C : 421. Fi : 7. W : 220.
- 4. What is its importance as a food crop in the United States?**
W-VG : 435. C : 421-422. Fi : 14-19.

2. Selecting location. — The sweet potato plant is very tender to cold and demands a high temperature and a long season. For these reasons it is mainly a southern crop. The soil must also be perfectly drained, warm, loose, and friable. Soils containing a high percentage of sand with a fairly retentive subsoil are ideal for this crop. There should also be an ample supply of plant food.

- 1. What are the most suitable climatic conditions for the growing of sweet potatoes?** W-VG : 439. L : 254. Fi : 19.
- 2. What kinds of soil are best for the growing of sweet potatoes?**
W-VG : 439. L : 254. C : 422. Fi : 21.

3. *Describe the soil and climatic conditions in the United States where sweet potatoes are grown most extensively.*

L:254. Fi:21-24.

3. Choosing varieties. — Varieties of sweet potatoes differ greatly in the shape, color, and quality of the tubers. Some of the most important varieties are Big-Stem Jersey, Yellow Jersey, Southern Queen, Pumpkin Yam, Georgia Yam, Red Bermuda, Florida, Pierson, Black Spanish, and Shanghai. The Big-Stem Jersey is the most popular on the northern and eastern markets.

1. *What varieties of sweet potatoes do your neighbors grow?*

2. *What variety do you think you should grow? What are your reasons for selecting it?*

3. *What are the leading varieties grown in the United States and what are their chief characteristics?*

W-VG:436-439. C:431. Fi:8-13.

4. *How do sweet potatoes differ in the character of the flesh?*

4. Obtaining seed. — Tubers of medium size are generally preferred for seed. They should be free from disease and handled with care to prevent bruising. Growers sometimes make selections of seed at harvest time. Two to four bushels of medium size seed are required to make enough plants for an acre. When two lots of plants are grown from the same seed, a bushel should produce 2000 to 2500 plants.

1. *What kind of seed should be chosen for the best results?*

W-VG:440.

2. *How many bushels of seed are required for an acre? For your project?* W-VG:440.

3. *What are the objections to the use of very small or very large tubers for seed purposes?*

W-VG : 440. Fi : 24-31.

4. *How should the seed be kept until time to start the plants?*

W-VG : 448. C : 428. Fi : 80.

5. Starting plants. — In the extreme South sweet potatoes are sometimes cut into pieces which are planted in the open very much in the same manner as white potatoes. However, in most regions, and especially in the North, the plants are started under cover in some kind of forcing device or house. A well-constructed hotbed (W : 44) will serve the purpose. Small, inexpensive houses, covered with glass or canvas, heated by steam, hot water, or manure, are often employed. It is nearly always necessary to supply a certain amount of bottom heat. Beds are made with a few inches of fine, sandy soil. The tubers, either whole or cut in halves with the cut surfaces down, are placed on the bed so that they do not touch each other, covered with about three inches of fine sandy soil, and watered. At the time of bedding the temperature of the bed should be about 80° F. and be gradually dropped to about 60° F., covering a period of six weeks. Plants will start from the tubers. In six weeks they should be well rooted and of proper size for setting in the field. The plants started in this manner are referred to as "slips," "draws," and "sets." They may be removed and a second lot of plants grown from the same tubers or seed pieces.

1. **Explain how sweet potato plants are started in practically all districts.**

W-VG : 441-444. L : 255. C : 423. Fi : 24-31.

6. Preparing the soil. — W : 222. While a thoroughly drained soil is essential to the culture of sweet potatoes, we should bear in

mind that there must be an abundance of soil moisture at the time of transplanting to insure the success of this operation, and all preliminary tillage should be managed with this in view. It is also exceedingly important to follow a system of cropping that will effectively destroy weed seeds. If cultivated crops are grown the preceding year, they should have the most thorough tillage so that no weeds will go to seed. Crimson clover is a desirable manurial crop to plow down for sweet potatoes.

Commercial fertilizers are universally employed for sweet potatoes. It is customary to use some nitrogen, 3 or 4 per cent, but an excessive amount should be avoided because it stimulates too much vine growth without a corresponding development of tubers. The mineral elements are essential and there should be no uncertainty about the required amount of both potash and phosphoric acid; 1000 pounds to the acre of a 3-7-10 fertilizer should be satisfactory under most conditions. It should be applied before planting and mixed very thoroughly with the soil. Well-decayed stable manure can be used to advantage, especially in thin soils.

1. What are the best crops to precede sweet potatoes?

W-VG : 444.

2. What preparatory tillage operations are necessary?

W-VG : 444. Fi : 31.

3. What fertilizer treatment do you recommend for sweet potatoes?

W-VG : 444. C : 423.

4. What lessons do the Experiment Stations teach relative to fertilizing sweet potatoes? W-VG : 445.

7. **Planting.** — Sweet potato plants should not be set out until they are well rooted, and until the ground is thoroughly warm and the danger of frost past. Either before or after a rain

is desirable, because of more favorable soil moisture conditions. If the ground is quite dry at the time of transplanting, it will be an advantage to puddle the roots and to use a little water with each plant. The plants are generally set 14 to 18 inches apart with 36 to 42 inches between rows. From 8000 to 12,000 plants are generally set on an acre of land.

1. When should sweet potato plants be set in the open ground?

W-VG : 446. Fi: 33-35.

2. What are the proper planting distances?

W-VG : 446. L: 255. C: 426.

3. How many plants will you need for your project?

8. Cultivating. — W: 44. Tillage should begin as soon as possible after planting. It is customary to work the soil between the rows up to the plants so as to form broad, flat ridges. Suitable cultivators are used until the vines render tillage impossible.

1. What tools will you need to cultivate the sweet potatoes?

Fi: 36-42.

9. Harvesting. — Though sweet potatoes are palatable before they have attained full size, the general practice is not to dig them until they have reached maturity. It is desirable to harvest them before frost has injured the vines, and when the ground is dry and there is bright sunny weather. The tubers should be allowed to dry in the field for a few hours and then be taken to either temporary or permanent storage.

1. What is the proper time and what are the best conditions for the harvesting of sweet potatoes?

W-VG : 448. L: 257. C: 428. Fi: 42.

2. What implements are used for this purpose?

W-VG : 447. L: 257. C: 428.

10. Storing and marketing. — A fairly high temperature and a dry atmosphere are necessary for the successful storage of sweet potatoes. In the large commercial storage houses a temperature of about 85° F. is maintained while the crop is being stored and for about ten days afterward and then the temperature is dropped to about 55° F.

Sweet potatoes are sold in a great variety of packages, including barrels, baskets, and hampers of various descriptions.

- 1. What are the requisites for the successful storage of sweet potatoes?**

W-VG : 448. L : 257. C : 428. Fi : 46.

- 2. What is the best method of grading and packing your crop for market? C : 430.**

CHAPTER EIGHT

BULB CROP PROJECTS

Onion, Cive, Leek, Garlic, Shallot

The group of bulb crops comprises onion, leek, cive, garlic, and shallot. They not only belong to the same family but are in fact different species of the same genus or group. All of these plants form bulbs similar in general structure to the onion bulb. Cives (spelled also chives) and shallot have cylindrical hollow leaves. In cives or chives the bulbs are very small and the plants grow in dense clumps. In shallot the bulbs are of fair size and the plants do not form clumps. Leek and garlic have flat solid leaves. In garlic the bulbs are made up of several secondary bulbs or bulbils inclosed in a white skin. Both the bulbils, often referred to as cloves, and the leaves are used for seasoning. The leaves of garlic are very narrow. The leaves of leek are broad and the bulbs small. Of this group the onion is by far the most important. All of these vegetables are hardy and may be grown successfully in any fertile, well-drained soil, though sandy loams are preferred. They thrive best in soils abounding in vegetable matter.

Project XV. Growing Onions

The onion belongs to the lily family. This family does not include many crop plants; the only other of great importance aside from the onion is asparagus. Numerous cultivated ornamentals belong here, such as lilies, tulips, hyacinths, and Spanish bayonets. Wild garlic, which is one of the worst weeds, is a close relative of the onion.

Onions have been cultivated since the earliest history of Egypt, India, and China. It is believed that the common onion does not now grow except under cultivation. Five hundred years ago the onion was common in Europe. The early colonists brought it to America.

The portion of the onion plant which is usually known as the onion is a bulb. Bulbs are underground structures consisting of short, usually conical stems, with many fleshy overlapping leaf-bases. Bulbs are food-storage organs. The food is stored in the thickened bases of the leaves, and these constitute the portion which we eat. The roots are fibrous, growing from the basal stem. The upper parts of the leaves are thick, fleshy, and hollow. The older leaves are on the outside. From the little conical stem at the base of the bulb is sent up a long, leafless stem, often hollow, which bears the flowers in a compact group at the top. In the common onion, this stem, or scape as it is called, is two or three feet high, smooth, and enlarged near the middle. Bulblets (small bulbs) are sometimes produced along with the flowers at the top of the scape. These forms are known as "top or tree" onions. These bulblets may be used for propagation. Some forms have compound bulbs which will separate into numerous bulbs, thus furnishing another method of propagation. These are known as "multipliers." Other forms are propagated by true seeds and by "sets," which are small bulbs grown from seed and checked in their development. The seeds are black, flattish on one side, convex on the other. In addition to the manner of propagation, onions differ greatly in shape, color, and size of bulbs, quality, and time of maturing. There also are marked differences between the so-called foreign types, such as Bermuda, Spanish, and Italian onions, and the American types.

1. How long have onions been cultivated?
2. What is a bulb? A bulblet?

3. Where and when are flowers produced?
4. What are the three types of onion based on methods of propagation?
5. What is an onion "set"?
6. What is meant by foreign and domestic types of onions?

Project Outline

1. Why grow onions?
2. Selecting location.
3. Choosing varieties.
4. Obtaining seed and sets.
5. Starting plants under glass.
6. Preparing soil.
7. Planting sets.
8. Sowing in the field.
9. Transplanting hotbed-grown plants.
10. Cultivating.
11. Weeding.
12. Thinning.
13. Irrigating.
14. Combating insects and diseases.
15. Marketing bunch onions.
16. Harvesting mature bulbs.
17. Storing.
18. Marketing.

1. Why grow onions?—The onion is one of the most important of the vegetables grown for American markets. Millions of bushels are grown annually in great commercial plantations, under the most favorable conditions, and it is a favorite crop among thousands of market gardeners. At least fair success

in its culture may be obtained in almost any properly treated soil and it offers rather unusual possibilities for profit in the best garden loams. The crop appeals especially to the grower who is greatly limited in the area available for gardening, because of its adaptability to the most intensive systems of cultivation. When good markets are near at hand, handsome profits may be made on very small plots.

1. **Will it pay you to grow onions?** If so, what reasons can you give for selecting this crop? C:308.
2. *Of what importance is the onion as a food crop in the United States? In other countries?* W-VG:380. L:162.
3. *To what extent are onions imported to the United States?* W-VG:380.

2. Selecting location. — W:228. As previously stated, onions may be grown successfully in any good, well-drained soil. However, this crop should be planted, if possible, in soils abounding in vegetable matter and in available plant food. If the largest bulbs are to be grown, soil conditions must be as perfect as possible. The largest areas of onions are on muck soils, which indicates at once the importance of humus for this crop. Sandy loams are also largely employed for the growing of onions. Good results are obtained in all types of loose, friable soils, and if their structure is not naturally favorable for this plant, especially liberal additions of rotten manure will be necessary.

The onion is a "cool" crop and it thrives in all northern climates, as well as in the South when advantage is taken of the cooler months.

It is an advantage in drilling seed and in all tillage operations to use soil that is at least fairly level.

1. What are the most favorable soil conditions for the growing of onions? W-VG : 384. L : 163. C : 310.
2. What types of soil should be chosen, if possible, for the growing of onions? W-VG : 384. L : 163. C : 310.



FIG. 59.—A basket of onions suitable for exhibition purposes. Different color bulbs should not be displayed together.

3. What climatic conditions does the onion prefer?
W-VG : 383. L : 162.
4. Where is this crop most largely grown for commercial purposes?
C : 310.
5. What can be said in favor of muck soils for the growing of onions?
W-VG : 384. C : 310.

3. Choosing varieties. — There are so many different varieties of onions that the amateur grower may have difficulty in deciding

which ones to plant. Some general decisions must be reached first. Does the market for which the onions are to be grown want yellow, red, or white bulbs? American varieties or the milder European type? Bunch onions or mature bulbs? Early mature bulbs or late ones?

If the plants are to be started under glass (W: 234), the Prize-taker should have first place. It is a very large, mild, yellow bulb, unusually well adapted to the "new onion culture" method, which consists in starting the plants under glass and transplanting later to the open ground.

Southport Yellow Globe and Danvers are the leading yellow sorts for sowing in the field, Weathersfield is the leading red variety, and Silver Skin the most popular white sort for field sowing. Sets of all these varieties may be grown or purchased. Silver Skin sets are planted more extensively than any other white variety.

1. **What varieties do you think will pay you best to grow? What are your reasons?** W-VG: 381. L: 172.
2. **Name and describe the leading varieties.**
W-VG: 381. C: 308-309. Catalogues.
3. **How may onions be classified?**
W-VG: 381-383. C: 308-309.
4. **What varieties are imported to the United States and from what countries?** L: 172.
5. **What varieties should be planted in the fall? Why?**
W-VG: 383. C: 308-309.
6. **What varieties should be planted for early maturity?**
W-VG: 382. L: 172.
7. **What is known about the history of the onion?**
W-VG: 380. C: 308.

4. Obtaining seed and sets. — There is a great difference in onion seed and sets, and too much care cannot be exercised in trying to obtain the best quality. Buy from the most reliable dealers. Seed more than a year old will not produce a good stand of plants. Sets should be of size desired, uniform and solid. Both sets and seed may be grown at home if desired.

1. Where can you obtain high-grade seed and sets? Consult local growers. Seed catalogues.

2. What should be the maximum age of seed?

W-VG : 385. C : 312.

5. Starting plants under glass. — W : 44-45. Prizetaker seed is often sown in hotbeds and greenhouses. The growing of the plants under glass is a simple matter, though the plants are more susceptible to damping-off fungi than most other vegetables (W : 74). This trouble may be controlled to a large extent by steam sterilization of the soil.

The transplanting method has several advantages, such as the production of larger bulbs, earlier onions, and a very great increase in the yield. The system appeals strongly to many growers who strive for the maximum yields to the acre.

Beds or flats may be used for starting the plants. Any rich, loose garden soil will be satisfactory for this purpose. The seed should be sown in drills half an inch deep and three inches apart. Most growers prefer to sow the seed at least ten weeks in advance of the date of transplanting in the field, which should be after the hardest frosts are past. Ten to twelve seeds to the inch should give a good stand of plants, and this should produce 8000 to 9000 plants per 3×6 foot sash. A temperature suitable for other plants that may be in the hotbed will meet the requirements of the onions. After the plants reach the height of about five inches they are cut back weekly to four inches to make them more stocky.

1. What is meant by the "new onion culture"?

W-VG:390. L:172. C:313.

2. What varieties may be sown to advantage under glass?

W-VG:390. L:173.

3. What are the advantages in starting onions under glass?

W-VG:390. L:173. C:313.

4. Describe the details of growing the plants.

W-VG:391. C:314.

5. How much seed will you need?

6. How many sash, mats, and flats will you require?

7. What are the disadvantages of this system?

6. Preparing soil.—W: 231. Since the onion does best in cool, moist soils, it is generally desirable to plow or spade the land late in the fall of the year so that there will be no unnecessary delay in starting the crop the following spring. Plow under a liberal amount of manure in the fall. If fall plowing is not feasible, this operation should have the earliest attention in the spring.

The presence of weeds in large numbers is a trouble which must be guarded against in every possible way. Not a weed should be allowed to ripen seed the preceding year on the plot which is to be used for onions. This will require the most thorough tillage. Nor should we lose sight of the fact that the soil should be very fine and moist when the time arrives for planting, which may require the repeated use of the harrow, plank drag, or other soil pulverizing and moisture conserving tools.

The onion requires the highest fertility. Large bulbs cannot be grown without an abundance of available plant food and humus

in the soil. The certainty of a large return justifies the most complete fertilizer treatment. It is not uncommon to apply a ton or more of high-grade fertilizer to the acre. There should be no shortage of any of the elements of plant food. Nitrogen is considered especially important. Any of the nitrogenous fertilizers may be employed to advantage. Nitrate of soda, in amounts of 200 or more pounds to the acre, is the most popular source of nitrogen for this crop. Part of the nitrate should be applied before planting and top dressings of 100 pounds to the acre may be made early in the growth of the crop.

If a ton of fertilizer is used to the acre, about 700 or 800 pounds of this amount should be acid phosphate. Potash is also regarded as highly important, though not to the same extent as it was regarded before the war. A good mixture may be made by using 300 pounds nitrate of soda, 500 pounds dried blood or tankage, 800 pounds acid phosphate, and 400 pounds muriate of potash.

Well-decayed stable manure is largely employed for onions. If very fine, it may be applied after plowing and thoroughly mixed with the soil by harrowing. Poultry manure is also excellent, and should be applied after the land has been plowed.

1. How will you proceed to have the soil well supplied with moisture at the time of planting? W:231. C:311.
2. What can be done to reduce the weed nuisance?
3. What are the fertilizer requirements of the onion?
W-VG:387. C:311.
4. How do nitrogen, phosphorus, and potassium function in the growing of onions?
5. What may be said about the value of stable manure and poultry manure for this crop? W-VG:387. L:164. C:311.

6. Give specific directions for the fertilizing of your onion ground. Estimate your needs.
L : 163-164. C : 311. W-VG : 387-389.
7. What kind and how much fertilizer is used for onions in the leading districts of the United States?
8. Suggest various combinations of fertilizer materials, specifying the amounts required of each.

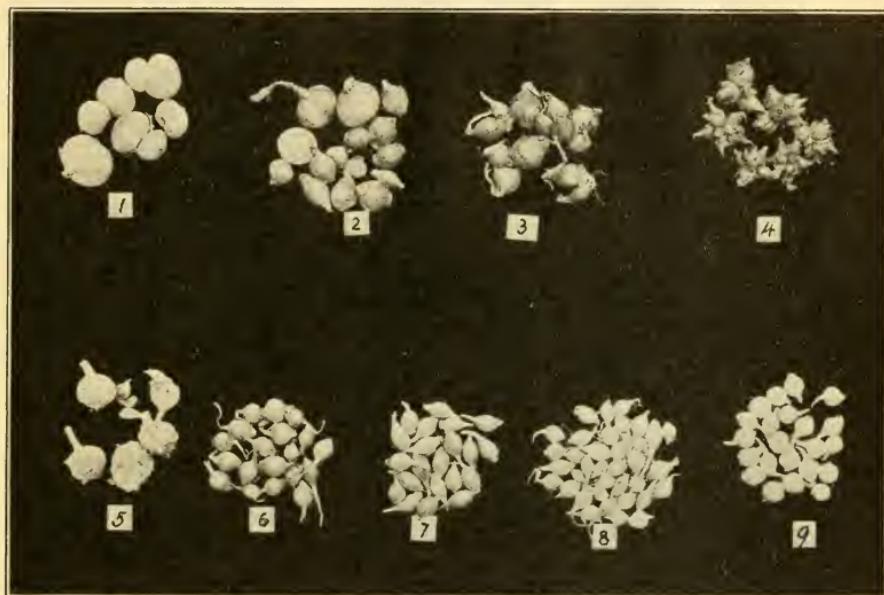


FIG. 60.—Onion sets of various types and sizes.

7. **Planting sets.**—Sets are used in large quantities for the growing of bunching onions. They are also generally employed by home gardeners for the production of mature bulbs, and to a considerable extent by commercial growers for an early crop of bulbs. Better results are obtained from sets than from seed in soils which are not very well adapted to the culture of onions.

It is customary to plant sets two or three inches apart (or closer if

wanted for bunching onions) in rows a foot apart. The rows should be perfectly straight, a condition which may be secured by the use of a line. The sets should barely be covered, unless the soil is very light, in which case they may be planted somewhat deeper. From 20 to 25 bushels of sets are required to the acre and more if sets are large. They should be planted just as early in the spring as the ground can be prepared.

1. When is it an advantage to use sets instead of seed?

W-VG : 392. L : 174-175.

2. How early in the spring should sets be planted? W-VG : 394.

3. What are the proper planting distances for sets?

W-VG : 394. L : 176.

4. How many bushels are required to the acre? W-VG : 394.

5. Are sets ever planted in the fall? If so, what kind and what method is followed? W-VG : 393.

8. **Sowing in the field.** — In the great onion-growing districts practically all the bulbs are grown from seed sown in the open ground. Good results may be expected in muck soils and in sandy loams or wherever conditions are favorable for growing this crop. The yellow American varieties are most largely employed for field seeding. It is customary to start the seed drills as early in the spring as the ground can be prepared. The rows are generally twelve to fourteen inches apart and it is customary to use about four and one-half pounds of seed to the acre. There should be eight to twelve plants per foot of row. If too much seed is used, it will be necessary to thin the plants. This is always a slow, tedious operation, so that it is important to know the viability of the seed and not sow more than is necessary.

Covering should not exceed one-half inch of soil on loam lands, while an inch may not be too much in light, sandy soils.

1. When is it desirable to use seed for the growing of mature bulbs? For the growing of bunching onions?

W-VG : 389. L : 174.

2. When should the seed be sown? W-VG : 390. L : 164.

3. How far apart should the rows be spaced?

W-VG : 390. L : 165. C : 313.

4. How much seed is required to the acre? W-VG : 390.

5. What varieties are most popular for field seeding? W-VG : 389.

6. How much seed will you need for your onion project?

9. Transplanting hotbed-grown plants.—Inasmuch as the hotbed-grown plants may be injured by severe frosts, they should not be set in the open ground too early, May 1 to 10 being as early as is desirable in most parts of the North. Planting should be postponed a little longer if plants are under size.

Small dibbers may be used for making holes for the plants or they may be set

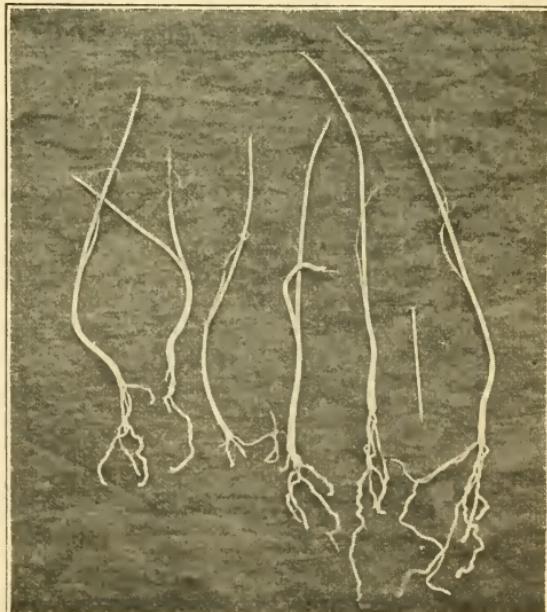


FIG. 61.—Onion seedlings; a shallow-rooted crop.

in shallow furrows. If large bulbs are desired, they should be spaced at least three inches apart in the row.

It is especially important to have the very best soil conditions for the growing of Prizetakers by the "new onion culture" method, and no more ground should be planted than can be properly enriched and cared for.

1. When should Prizetakers be set in the field?

W-VG : 392. L : 174.

2. Explain the details of transplanting.

W-VG : 394. L : 174. C : 314-315.

Students will find reference (Gr) exceedingly valuable in the growing of onions by the transplanting method.

10. Cultivating. — W : 235. Cultivators must be used at close intervals if the soil is to be kept in proper condition. If the weeds make very much of a start, it is tedious and expensive to get rid of them, so that the economic policy is to use the wheel hoes frequently, not only to keep down the weeds but for the conservation of soil moisture and for other reasons discussed in the Tomato-Growing Project. (W : 37.) We should not lose sight of the fact that the onion is a shallow rooted crop and that tillage should not at any time disturb the development of the roots. The horizontal blades or sweeps of the wheel hoe are excellent for destroying weeds and should be used when there is danger of their interfering with the root growth. Both single-wheel hoes and double-wheel hoes are used in cultivating onions and sometimes the rows are far enough apart to permit the use of horse cultivators.

1. How frequently should onions be cultivated?

W-VG : 394. L : 165. C : 315.

2. What tools may be employed? W-VG : 394. L : 165.

3. What should be the character of the cultivation?

W-VG : 394. C : 315.

11. Weeding. — W : 307. Though the most perfect cultivation may be given onions, some hand weeding is nearly always required to destroy weeds in the rows. Various types of small hand weeder are in common use. It is important to keep the plantations entirely free from weeds.

1. What hand tools will you select to weed your onions? Give reasons for selecting them. W-VG : 394. L : 166.

12. Thinning. — W : 308. It is customary to remove some of the plants at the time of weeding, if they are too close together. As stated in W : 238, most growers want from eight to twelve plants to the foot of row. If the soil is very fertile and large bulbs are wanted, a minimum number of plants should be left.

1. What will be your policy in the number of plants left per foot of row?

13. Irrigating. — W : 235. The onion responds to the most perfect cultural conditions. Some growers are so anxious that there be no unfavorable conditions at any period of growth that they install overhead irrigating or sprinkling devices so that artificial rain may be produced at will. There are times when a thorough watering is urgently important, and fortunate is the grower who is prepared to supply all the water that the crop may need and at the time it is needed.

1. Would it pay you to install an irrigating system for this and other crops that you intend to grow?

14. Combating insects and diseases. — W-VG : 405. Owing largely to cultural methods, onion insects are difficult to handle.

Close planting of rows prevents the use of horse-drawn implements so that growers are apt to bear with insect depredations rather than resort to the use of hand outfits. Some extensive truckers are now planting onions with skip rows, so that when spraying operations are necessary traction machines can be used without injury to the plants.

It is not uncommon for the leaves of onions to turn white in midseason and wilt. This is due to a small, white, soft-bodied, insect (onion thrips), the larva of a minute fly, which punctures the leaf with its needle-like mouth parts and destroys the cells while sucking the plant juices. The adult thrips pass the winter in old onion tops or in rubbish. In the spring the "flies" go to new onion plantings where they deposit eggs in the leaf. Adults, eggs, and larvæ may be found on the plants during the summer or until reproduction is stopped in the autumn. Contact sprays applied before the leaves are badly affected will control the insect. Black Leaf 40, one pint in 100 gallons of water to which is applied 4 or 5 pounds of dissolved soap, is effective when applied with force and in large quantities.

Onion bulbs are sometimes dwarfed or the plants destroyed soon after growth has commenced by a whitish maggot which bores into the underground stem. Entire fields are often destroyed by this pest. The insects pass the winter usually as puparia from which adults emerge in the spring. Eggs are laid in the leaf sheath or on the ground, and upon hatching the maggots work into the young bulbs. In two or three weeks the maggots mature, change into pupæ in hardened, brownish puparia. Several broods of the insect occur each year. Until recently no satisfactory control was known. Sweetened poison bait has proved the most satisfactory remedy.

Smut is a disease of onions which sometimes causes serious losses. The fungus causing the disease lives through the winter in the soil and attacks young seedlings. Onions grown from sets

are never diseased. Smut may be recognized by dark spots on the leaves. Later these spots break open exposing black sooty masses of spores. In truck gardening regions it is often necessary to disinfect the soil at planting time by applying a formaldehyde solution. This is done by a drip attachment on the seed drill.

Downy mildew, a disease which has many of the characteristics of the late blight of potatoes, is sometimes a destructive disease. Its first effects are noticeable by the peculiar withering of the tips of leaves. The affected plants soon wilt and the trouble spreads to other plants. Spraying with Bordeaux is the best method of control.

Black spot may develop on the outer scales and become conspicuous especially during storage. The chief injury is to appearance. Neck rot often causes severe losses in storage. Thorough drying before storage is important in controlling these troubles.

1. **Describe the injury done by thrips to onions.** CL : 245, 248.
2. **Is soil a factor in the attacks of thrips?** CL : 245, 247.
3. **What is the life history of the onion thrips?** CL : 245, 247.
4. **What are some contact sprays, and which is the most efficient against onion thrips?** CL : 248-249.
5. **What is the life history and appearance of the onion maggot?** CL : 243-244.
6. **What are the puparia?** CL : 244.
7. **What is the formula for poison bait?** CL : 245.
8. **How may onion smut be recognized?** SH : 201-203.
9. **In severe cases what measures are necessary to control onion smut?**

10. *How can downy mildew of onions be controlled?* SH : 203-205.

11. *What precaution assists in preventing black spot and neck rot?*

15. Marketing bunching onions. — Before pulling any of the bunching onions it is important to visit the markets to be supplied and learn what is the usual method of marketing. First, note the number of onions in each bunch and also the size of the onions; second, whether they are clean and neatly bunched; third, the kind of tying material used. Then study how you can improve on the methods you have observed. It is especially important to see that the bunches are neat and clean, and tied with strings or tape that enhance rather than mar the appearance of the bunches.

1. **What methods are employed in your neighborhood in the marketing of bunching onions?** W-VG : 404.

2. **What methods will you employ?**

16. Harvesting mature bulbs. — Sometimes the market is so good for onions that we are justified in harvesting them before they are fully mature. Ordinarily, the bulbs should not be harvested until they are fully ripe, as indicated by the dead and shriveled tops. Dry, sunny weather is most favorable for this operation. Several rows of onions are pulled and thrown together into a windrow. They are left undisturbed for a few days and then stirred occasionally with a wooden rake to facilitate drying. The tops should be removed with shears or knife, leaving about an inch of the neck. If ample space is available in a shed or loft, so that the bulbs can be spread in layers only a few inches deep, they need not dry so long in the field.

1. **What is the proper time to harvest mature onions?**

W-VG : 396. L : 168. C : 316.

2. How should the bulbs be removed from the soil? Are tools or machines ever used for this purpose?

W-VG : 396. L: 169-171. C: 316.

3. What is done with the bulbs after they are pulled?

W-VG : 397. L: 170. C: 316.

4. What is considered a satisfactory yield to the acre? W-VG : 400.

5. To what extent is the yield reduced if the rows are far enough apart to work with a horse?

17. Storing.—Onions should not be placed in permanent storage until thoroughly dry. The requirements of successful storage are thorough ventilation, a dry atmosphere, and the impossibility of alternate freezing and thawing. In the great commercial storage houses, an effort is made to maintain the temperature as low as possible without actual freezing. This, of course, cannot be done in most farm buildings, so that the main thing to guard against is alternate freezing and thawing that invariably destroys the bulbs. If there is a location where the bulbs can be frozen and then covered with hay to hold the frost until they are wanted for sale, the results will be satisfactory. Thick-necked specimens should be marketed early in the fall.

1. What are the essentials for the successful storage of onions?

W-VG : 397-400. L: 171. C: 317-318.

2. What method do you intend to use?

3. What do you know about the construction and management of the large commercial storage houses?

W-VG : 398. L: 171. C: 318.

4. *What are the relative merits and cost of bags, crates, and bins for the storage of onions?*
5. *What is the shrinkage of onions in storage?*

18. Marketing mature bulbs. — W : 244. Onions should be carefully graded into at least three sizes before they are marketed, though this is not generally practiced. Grading nearly always increases the net returns from the crop. They are sold in a great variety of packages and here is an opportunity to exercise good judgment as well as originality. Clean, white, attractive packages of medium size may be a great advantage in the disposition of the crop. The dead stems and loose leaves should be carefully removed. It is especially important to market very large superior bulbs, of the foreign types, in the most attractive manner.

1. **When will it pay you best to sell your crop?**
2. **How will you prepare the bulbs for market? W-VG : 400.**
3. **What packages will you use? W-VG : 400.**
4. *What does it cost to grow and market an acre of onions?*
W-VG : 401.
5. *What profits should be realized to the acre?* W-VG : 401.

CHAPTER NINE

PULSE CROP PROJECTS

Bean, Pea

The bean and pea are closely related botanically, though they differ very greatly in cultural requirements. The bean is tender to frost while the pea stands very hard frosts or even severe freezing under certain conditions. Some types of beans, as the lima, must have a long, warm season, while the pea is a cool, short-season crop.

Project XVI. Growing Beans

Beans belong to what is known as the pea or pulse family. "Legume" is also a popular name for members of this family. The importance of this family agriculturally is probably greater than any other except the grass family. Here belong, in addition to beans and peas, clover, alfalfa, vetch, cowpea, soybean, and peanut. About 10,000 species belong to this family, of which about two fifths are American, distributed both in temperate and tropical regions. The common or kidney bean is believed to be a native of tropical America.

The genus to which the kidney bean belongs includes also the lima bean and the scarlet runner bean. The broad bean, soybean, and a number of other beans do not belong to this genus.

The beans are seeds and are produced in fruits commonly called pods. There are both green-podded and wax-podded varieties. The pods are made up of two valves which separate along both lines or edges at maturity. Stringiness of the pods of string or snap beans is due to tough fibers which develop along the unions

of the valves. The plants are commonly divided into two classes, pole and bush; the former a climbing and the latter a dwarf type of the same species. The leaves are compound, with three leaflets, and the flowers are of a true legume type with a standard, two lateral wings, and a keel. In the common bean the keel is coiled.

1. What can be said of the importance of the pulse family?
2. What is another popular name for members of this family?
3. Is this a large family and is it well represented in America?
4. What part of the plant are the beans?
5. What is meant by the terms pole and bush?

Project Outline

1. Why grow beans?
2. Selecting location.
3. Classifying and selecting varieties.
4. Obtaining seed.
5. Preparing soil.
6. Planting field beans.
7. Planting dwarf, snap, and green shell beans.
8. Planting pole beans.
9. Planting lima beans.
10. Cultivating.
11. Combating insects and diseases.
12. Harvesting and marketing.

1. **Why grow beans?**—The growing of beans is often very attractive as a business proposition. There are practically no sections where some of the varieties cannot be grown. Glass

is not required to start the plants, though it is sometimes an advantage. The culture of beans is comparatively simple and the crop is especially desirable for those who have had no practical gardening experience. Before undertaking the culture of beans on a large scale, we should be reasonably certain of a satisfactory market.

1. Is your market well supplied with beans?

2. Will it pay you to grow beans?

2. Selecting location. — W : 247. As previously stated the bean is tender to frost and there will be a distinct advantage for the early plantings in selecting areas with good air drainage. Loss from frost, however, can generally be avoided by planting late enough to escape such a disaster.

Beans are grown successfully in all soil types, though sandy loams provide the best conditions. Cold, heavy soils should be avoided, and under no circumstances should beans be planted in poorly drained soil.

1. Where are beans grown most successfully in your neighborhood?

2. What kind of soil is best for beans?

W-VG : 233. C : 128. S-B : 13.

3. Do you have a suitable soil for beans?

4. What is the nature of the soil in the South where beans are grown so largely for northern markets?

5. What is the nature of the soil in other bean-growing districts of the United States?

3. Classifying and selecting varieties. — Beans may be divided into two general classes, namely, field beans and garden beans, and the garden class may be subdivided as follows:

Garden Beans	Bush	{ Kidney Lima	{ Wax Green-Pod
	Pole	{ Kidney Lima Runner (Scarlet Runner)	{ Wax Green-Pod

By the term snap bean is meant beans which may be eaten with the pod and they may be either bush or pole in habit of growth. This class of beans is also often called "string" beans, though a good string bean is stringless. Green shell beans are those which are shelled and used before they are fully ripe, in distinction from dry shell beans, which are allowed to ripen and dry before they are cooked.

There are many good varieties of beans. The following are some of the leading varieties:

Dwarf Wax-Podded: Burpee's Kidney, Wardwell Kidney, Improved Golden Wax, Brittle Wax.

Dwarf Green-Podded: Burpee's Stringless, Red Valentine, Refugee, Bountiful.

Green Shell: Goddard, Dwarf Horticultural.

Dry Shell or Field: Navy, Marrowfat, Red Kidney.

Wax-Podded Pole: Golden Carmine, Golden Cluster.

Green-Podded Pole: Creaseback, Kentucky Wonder, Lazy Wife.

Pole Lima: Leviathan, King of the Garden, Dreer's Improved.

Bush Lima: Henderson, Fordhook.

1. What varieties of beans will you plant and why have you selected them?

W-VG : 230-232. S-B : 117.

2. How may beans be classified?

W-VG : 226-230. L : 205. C : 123-125. S-B : 3.

3. *What is known about the history of beans?* W-VG : 226. S-B : 1.
4. *What varieties are grown mainly in the South for shipping to northern markets?* W-VG : 230. S-B : 124-125.
5. *What varieties are grown in your neighborhood?*
6. *What varieties are grown in the greatest commercial districts of the United States?* S-B : 117-125.

4. Obtaining seed. — It is a simple matter to save seed from choice plants. Thousands of American home gardeners and some commercial growers follow this practice. Most of the seed, however, is bought from dealers who have their stocks grown by contract in districts which are unusually favorable for the growing and curing of seed.

1. **Do you know how to select your own seed? Will it pay you to do so?** S-B : 43-49.
2. **How much seed will you need for your project?**
3. *Where are most of the seed beans produced and under what soil and climatic conditions?*

5. Preparing the soil. — The soil should be well prepared for beans. They may be grown in rotation with other garden crops. When a heavy clover sod is available, it is ideal for beans, if plowed down in the fall, or at least several weeks in advance of bean planting.

It is not customary to make heavy applications of fertilizers for beans. About 500 pounds to the acre of a mixture high in phosphorus should give good results.

1. **What preliminary crop do you recommend for beans?**
W-VG : 234.

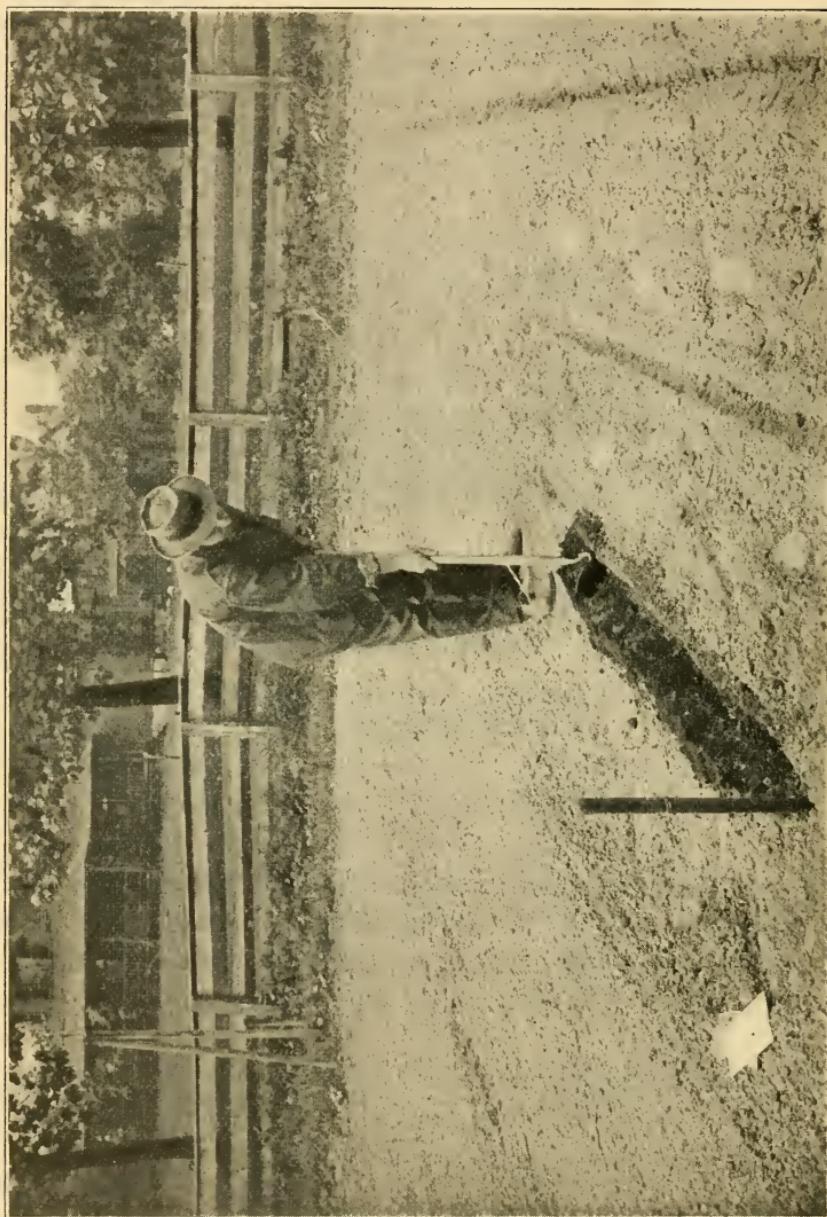


FIG. 62.—Making furrow with hoe for seed sowing.

2. What soil tillage preparations do you think should be made?
S-B: 71.

3. How will you fertilize your beans?
W-VG: 235. C: 139. S-B: 15-20.

4. What is the function and importance of nitrogen, phosphorus, and potassium in the growing of beans? S-B: 15-20.

5. When should the fertilizer be applied?

6. How are beans fertilized in the important bean-growing sections?

6. Planting field beans.—Field beans should not be planted too early because they may rot in the ground, or frost may kill the plants, and earliness is not particularly important. Rust is also more likely to develop on early plantings and cold, wet weather may retard and stunt the plants. The most common spacing between rows is twenty-eight inches



FIG. 63.—Distributing seed from an envelope.

and the beans should be dropped from two to four inches apart. They are sometimes planted in hills ten to twelve inches apart and this is an advantage in getting a good stand of plants. The depth of covering in heavy soil should be about one inch and a trifle more in light soils. In well-prepared moist soil, shallow planting is very desirable.



FIG. 64.—Firming the soil over the seed with a hoe.

1. What is the proper time for planting field beans in your neighborhood?

W-VG : 236. C : 129. S-B : 71-73.

2. What planting distances do you recommend and what is the proper depth to plant?

W-VG : 236. C : 129.

3. How are field beans planted in the great producing districts?

W-VG : 236. S-B : 71-76.

7. Planting dwarf, snap, and green shell beans. — If the beans are to be cultivated with a wheel hoe, it is unnecessary to allow

more than 16 to 18 inches between rows and about 28 to 30 inches for horse cultivation. Depth of seed covering will vary with the character of the soil, (W: 254), though there should seldom be more than two inches of soil over the beans. The beans should be dropped two to four inches apart. Some growers prefer to drop about four beans in hills ten inches apart. Then hand hoes may be used between the hills to destroy any weeds that may appear in the row.

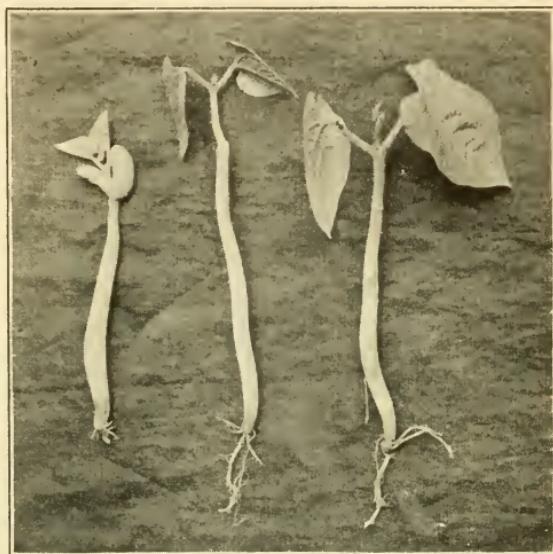


FIG. 65.—Bean seedlings. These plants contain so few roots that it is difficult to transplant them successfully.

1. When should this class of beans be planted? Will it pay to take some risk in planting at an early date?

W-VG: 237. L: 206. C: 140.

2. What should be the planting distances, and the depth of planting? W-VG: 237. L: 206. C: 140.

8. **Planting pole beans.**—Pole beans are generally planted in hills 3×4 or 4×4 feet apart. Sometimes they are planted in drills and supported by poultry netting or some other device. From four to six beans are planted in a hill and the plants thinned to about three plants.

1. When and how would you plant pole beans? W-VG: 238.

9. Planting lima beans. — Lima beans are very tender to cold and must not be planted until the ground is warm and there is no danger of frost. They are usually planted in hills 4×4 feet apart and the bush limas in drills as explained for other types of bush beans. W: 254. Sometimes bush limas are started in pots under glass about four weeks in advance of field planting, and transferred to the field without disturbing the roots. Poultry netting



FIG. 66.—Companion cropping is necessary for best returns on land of high value.

and other forms of wire trellis may be employed, if desired, to support pole limas.

1. When and how would you plant lima beans?

W-VG : 238. L : 208.

10. Cultivating. — W : 251. Beans should have just as thorough cultivation as is necessary to maintain a mulch of fine soil. This is a shallow rooted crop and we must be careful to avoid severe root pruning. S-B : 77-80.

1. What tools will you need to cultivate your beans? W-VG : 240.

11. Combating insects and diseases. — Legumes suffer damage from sucking insects such as aphids, or caterpillars which feed on the vines. Weevils working in seeds in the field, or in storage, annually cause tremendous losses to crops of beans and peas.

The bean weevil is very destructive in the warmer climates, but does not seem to be so harmful in the more northern areas. The adult, a mottled beetle, places its eggs within the pod and from these young larvae hatch and work into the bean, and eat out a sizable cell in which the grub matures. The insect com-

pletes its transformation in the seed, and then escapes through a small round hole in the shell, and deposits eggs for another generation of the pests. Several broods may occur, and, if the beans are left undisturbed, they are soon reduced to a powdery condition. Weevil beans are unfit for seed, for even if only slightly injured, the plants which germinate are sickly or the beans may carry the weevils to the field in this manner. They may be controlled by fumigation.

Anthracnose or pod spot is one of the most serious diseases of the bean, often causing enormous losses. The symptoms are most noticeable upon the pods, where the disease appears as sunken, dark-colored spots. Similar spots may be found upon the stems and leaves. Anthracnose is most commonly spread

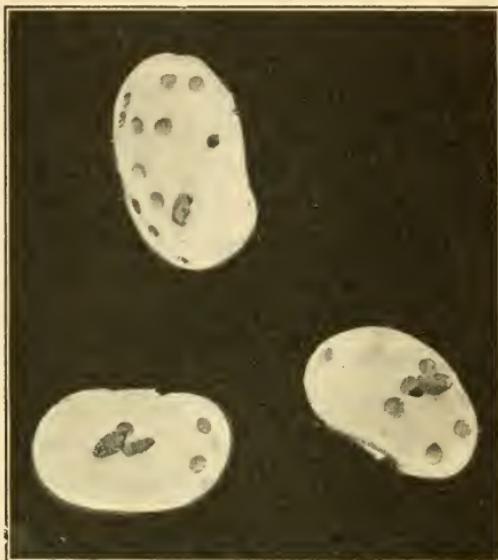


FIG. 67.—Bean weevil and injury to stored beans.

by diseased seeds. Control of this trouble is largely a matter of planting clean seed. Clean cultivation and crop rotation are also advisable. Vines should not be cultivated when they are wet. Lima beans are resistant to this disease.

Blight is the name given to a common bacterial disease which attacks all varieties of both field beans and lima beans. Upon the leaves large, brown, watery spots are produced which become dry, thin, and papery. The disease soon extends to the pods, where similar watery spots are developed. Blight is spread by infected seeds, and the methods of control are therefore similar to those for anthracnose.

Rust may be distinguished from the above-mentioned diseases by the fact that small blister-like spots are found on the leaves and stems. These break open and are full of rusty brown or blackish powder, which is in reality the spores of the fungus. Rust usually develops rather late in the season but is often the cause of very severe damage. The use of the resistant varieties forms the most effective means of control.

1. *What is the life cycle of the bean weevil?* CL: 58-59.
2. *How can the adult be distinguished?* CL: 57-58.
3. *Name three other bean weevils.* CL: 60-63.
4. *What is the best remedy?* CL: 64.
5. *What caution should be taken in handling carbon bi-sulphide?* CL: 63.
6. *What are the symptoms by which anthracnose of beans may be recognized?* SH: 152.
7. *How may anthracnose be controlled?* SH: 154.

8. *How is blight distinguished from anthracnose?* SH : 155.

9. *What are the characteristics of bean rust?*

12. Harvesting and marketing. — Garden beans must be picked by hand and it is important for the work to be done when the pods are at the proper stage of development, or they may become overripe and their quality will be sacrificed. This statement applies to all varieties of garden beans. Snap beans should produce about 200 bushels to the acre. They are marketed in baskets of various types.

1. **When should garden beans be harvested?**

2. **How do you intend to market your crop?** W-VG : 242.

3. **What kind and how many packages will you need?**

C : 141-145.

Project XVII. Growing Peas

Peas are important members of the pea family, as the common name of the family suggests. The plants either trail on the ground or climb. The leaves are compound with one, two, or three pairs of leaflets. The terminal leaflets and often the upper lateral ones are modified into tendrils for climbing. Stipules, structures at the union of the leaf stalk and the stem, which in many plants are small or lacking, are large and leaf-like in the pea plant. The flowers are of the legume type. The fruit is a typical pod or legume and contains the seeds which are commonly known as "peas." There are two recognized types of peas. Garden peas with white flowers and uniformly colored seeds, and field peas with colored flowers and seeds speckled with fine spots of various colors. The garden peas may be divided into two groups, shelling peas and the edible podded or sugar peas. The shelling peas are

also divided into two groups, the smooth-seeded and the wrinkled-seeded. Each of these groups and the sugar peas occur in tall, dwarf, and half-dwarf forms. In general the smooth-seeded varieties mature earlier and the wrinkled-seeded later. The former are more hardy. Dwarf and half-dwarf forms ripen earlier than the tall sorts.

1. What provision do peas have for climbing?
2. What parts of the plant show clearly all family relationship?
3. How do garden peas and field peas differ?
4. Which types of shelling peas mature early? Late?

Project Outline

1. Why grow peas?
2. Selecting location.
3. Classifying and selecting varieties.
4. Obtaining seed.
5. Preparing the soil.
6. Planting.
7. Companion cropping.
8. Cultivating.
9. Supporting the vines.
10. Combating insects.
11. Harvesting and marketing.

1. **Why grow peas?** — The pea is one of the most popular vegetables grown in America. The sweet, tender, fresh peas are a delicacy on any table, and their culture may be profitable wherever markets are available. They give quick cash returns, and the early crop is harvested in ample time to follow with beans,

late potatoes, or other vegetables which will mature before the end of the growing season.

1. Do you have a satisfactory market for peas? Do you think they will pay you better than some other vegetables which you grow?
2. Selecting location. — W: 262. The pea thrives in a cool, humid climate and in fertile soils with an abundant and constant supply of moisture. The North naturally provides the best conditions for this crop, though it is grown with excellent success in the South when advantage is taken of the cooler months. Peas do best in fairly loose, friable soils that contain a good supply of humus. All things considered, the sandy loams provide the best conditions.
1. What are the best soil and climatic conditions for the growing of peas? W-VG: 410-411. C: 334.
2. Do you have a suitable location for growing peas?
3. What is the character of the soil and climate where peas are grown on a large scale for canning?
3. Classifying and selecting varieties. — Varieties of peas may be classified according to their habit of growth into dwarf, half-dwarf, and tall. They may also be classified as smooth, wrinkled, and edible-podded or sugar. The smooth varieties are hardier than the wrinkled ones and may be planted somewhat earlier. The wrinkled varieties are sweeter and better in quality than the smooth type, and are especially desirable for a fancy trade demanding the highest quality.

There are many excellent varieties of peas, the following being very popular:

Extra Early Smooth Peas: Alaska and Best Extra Early.

Extra Early Wrinkled Peas: Gradus, Thomas Laxton, Nott's Excelsior, Blue Bantam, Little Marvel.

Medium and Late Peas: Improved Stratagem, Telegraph, Telephone, and many other good varieties.

Edible-Podded: Giant Sugar, Dwarf Gray Sugar, and Mammoth Melting Sugar.

1. **What varieties do you intend to plant and why have you selected them?** W-VG : 409-410. C : 339. Catalogues.

2. **How may peas be classified?**

W-VG : 409-410. C : 332. S-P : 1-4.

3. **What are the chief varieties grown for canneries?** S-P : 45.

4. **Obtaining seed.** — It is customary for growers to rely almost wholly upon dealers for their supply of seed.

1. **Where can you obtain good seed of the varieties desired?**

5. **Preparing soil.** — W:261. As peas thrive best in a cool, moist soil, and as they should be planted very early in the spring, it is desirable to plow the land in the fall and harrow it just as soon as it is dry enough in the spring.

Land which has been highly manured for the preceding crop is likely to furnish ideal conditions for the growing of peas. Fresh stable manures should never be applied immediately before planting peas, but well-decayed manures may be used freely and this is a great advantage in heavy soils.

Inasmuch as the pea is a legume and acquires nitrogen from the atmosphere, this element is never used in large amounts for the growing of peas. It is believed that applications of potassium are beneficial and there is no doubt about the necessity of liberal amounts of phosphorus. If the soil is in first class condition, it is

likely that about 400 pounds of acid phosphate to the acre would give very good results without any applications of nitrogen or potassium.

1. When and how should the land be prepared for peas?

C : 334. S-P : 7-11.

2. What kind of crop is best to precede peas? S-P : 7.

3. How will you fertilize the land for peas? W-VG : 411. S-P : 9.

4. How are peas fertilized in the sections where they are grown largely for canneries?

6. Planting. — The first planting of smooth peas should be made in the spring as early as the ground can be prepared and successive plantings may be made for several weeks, though the earliest plantings generally produce the largest crops. It is customary to plant the wrinkled kinds somewhat later because there is some danger of the seeds rotting in the soil if the weather is very cool and wet.

The rows vary from 18 inches to 4 feet apart, depending on the height of variety, method of cultivation, and whether supports are used for the vines. Seed should be used freely in order to obtain large yields, and this is especially true of the dwarf varieties. From one to two pints of seed to 100 feet of drill will give a good stand of plants.

The earlier plantings are not covered with more than an inch of soil, unless it is very sandy, while the depth of covering at planting should increase as the season advances, so that the roots of the plants will be at a depth where the soil is cool and moist. When the seeds are covered with three to five inches of soil it is desirable to fill the furrow gradually as the plants increase in height.

1. When should smooth varieties of peas be planted? Wrinkled ones? W-VG : 412. L : 110. C : 335. S-P : 15.

2. What should be the space between rows for varieties of different height? W-VG : 412. C : 335.

3. What is the proper rate of seeding?

4. How deep should peas be planted? W-VG : 412.

7. **Companion cropping.** — It is often possible to grow other vegetables with the peas. For example, if the pea rows are three feet apart, there might be two rows of button radishes between them and the radishes will be marketed before there will be any interference from the pea vines. Numerous other intercropping plans containing peas are commonly employed by market gardeners.

1. *Do you think it will pay you to grow one or more other crops with peas? If so, what crops and what plan would you recommend?*
W-VG : 479, 484.

8. **Cultivating.** — W : 256. Peas should have practically the same cultivation as beans.

9. **Supporting the vines.** — No support of any kind is used in the great commercial plantations, but home gardeners as well as some market gardeners find it profitable to grow the taller varieties which require support. Poultry netting is often employed, and with good care will last for many years. Brush is often used and sometimes twine is stretched between stakes.

1. *Will it pay you to support the vines? If so, what kind of support will you provide?*
W-VG : 412. C : 335.

10. **Combating insects.** — The pea aphis is one of the most serious insect pests. Tobacco dust, scattered on the rows as soon

as the plants are up, is valuable, but the standard treatment is to spray the plants thoroughly with nicotine solutions.

W-VG : 413. CL: 54, 71, 79. S-P: 36-43.

Unlike the bean weevil, the pea weevil does not work in dried peas. Infested seed, even if the germ is not destroyed, produces weakened vines which do not set a normal number of pods. The beetles are similar in color to the bean weevil, but are larger. Eggs are laid on the surface of newly forming pods and the young weevil works through the pod into a pea, where its development is completed. The insect is single brooded, and remains in the seed over winter, or may leave it and hibernate in rubbish near by. It may be controlled by fumigation.

Peas are subject to several diseases of the foliage, stems, and roots, most of which are of only local or minor importance. Spot is a disease which results in a spotting of the stems, leaves, and pods. It is most noticeable on the pods when the spots are circular and sunken and is apt to be the most serious when the stems are attacked. Pea spot may be controlled by crop rotation and the planting of clean seed. Powdery mildew is another disease often spread in infected seed. It may be controlled by spraying with Bordeaux mixture. Bacterial blight is a disease of importance in some sections. The stems and leaflets become watery and discolored a yellowish-brown. Stem rot may be of importance as a disease of seedlings. Liming the soil is often beneficial.

1. *In what respects do the pea and the bean weevil differ?* CL: 55.
2. *What is the life history of the pea weevil?* CL: 55-56.
3. *Should weevil peas be planted? State reasons.* CL: 56.
4. *Is it safe to store peas and beans as seed?* CL: 64.
5. *Is control practicable? If so, describe the method.* CL: 64-65.

11. Harvesting and marketing. — Peas should be picked after they have attained full size but before they have hardened. This requires alertness and prompt action on the part of the grower.

Green peas are generally sent to market in the pod, but when labor is available it may pay to shell them for local market.

1. **What is the best way for you to market your peas?** W-VG : 413.
2. *What profits might you realize per acre?*

CHAPTER TEN

PERENNIAL VEGETABLE PROJECTS

Asparagus, Rhubarb, Jerusalem Artichoke, Globe Artichoke

Asparagus, rhubarb, Jerusalem artichoke, and globe artichoke comprise the perennial group of vegetables, and they are mentioned in order of importance. The artichokes are of so little importance that they are not given consideration as projects. The perennial vegetables are grown successfully throughout the North. They require fertile, well-drained soils.

Project XVIII. Growing Asparagus

Asparagus belongs to the lily family. Asparagus and onions are about the only crop plants of this large family, but numerous ornamental plants and some bad weeds belong here. Asparagus is a native of Europe and Asia, where it has been under cultivation for more than 2000 years, having been known to the ancient Greeks and Romans. It is a rugged plant able to withstand dry and poor soil but doing best in well-tilled soil rich in vegetable matter. In addition to common garden asparagus, there are several closely related ornamental species of asparagus. The so-called "asparagus fern" (*A. sprengeri*) and "plumy asparagus" used for decorative purposes and hanging baskets, and the "smilax" of greenhouses belong to the same genus as the edible asparagus.

Asparagus has two sorts of stems, those growing underground and those coming above the ground. The underground stems

together with the attached roots form the "crown." From the crown are sent up stems or shoots, at first thick and fleshy, which are often called the "spears" and which form the edible part of the plant. Scale-like growths on these fleshy stems are the real leaves. In fact all of the leaves of the asparagus plants are small scales which do not function at all as ordinary leaves. The green, filmy, leaf-like structures are in reality stems which are finely divided and which perform the functions of leaves. The flowers are inconspicuous both on account of their small size and greenish-yellow color. Flowers which develop pollen-bearing organs and flowers which develop fruits and seeds are borne on different plants. The former are considered to be more productive. The fruit is a roundish red berry and usually contains two dark triangular seeds. The seeds remain alive for a long time, possibly four or five years.

1. How long has asparagus been under cultivation?
2. How are the "asparagus ferns" and "smilax" related to common asparagus?
3. What part of the plant is the fleshy "spear"?
4. What is the structure of the filmy green growth?
5. How do the plants differ in the kind of flowers produced?

Project Outline

1. Why grow asparagus?
2. Selecting location.
3. Selecting varieties.
4. Starting the plants.
5. Preparing the soil.
6. Planting.
7. Cultivating.

8. Combating insects and diseases.
9. Maintaining fertility.
10. Harvesting and marketing.

1. Why grow asparagus? — Asparagus is considered one of the most profitable of the vegetable crops, wherever satisfactory markets are available. It is a crop, too, that responds well to scientific treatment, thus enabling thoughtful and careful growers to make splendid returns.

The growing of asparagus does not appeal at first to gardeners of little experience who are anxious to realize profits at the earliest possible date, but to those who are willing to wait a few years for returns it offers excellent business opportunities. Well-managed plantations will produce profitable crops for fifteen years or even longer, if the market does not object too seriously to the diminishing size of the shoots, which is likely to occur after the plantations are eight to ten years old.

When strong roots are planted in rich soil and given the best treatment, they should produce about \$50 worth of asparagus to the acre the second season, without causing any harm to the plants. The third year probably \$200 an acre can be cut without any devitalizing effect on the plants, and \$300 to \$500 thereafter, depending on the size of the crop and condition of the market.

- 1. Will it pay you to undertake the growing of asparagus as a business proposition?** W-VG : 223.
- 2. What should be the gross returns over a period of ten years? The net profits?** W-VG : 223.
- 3. What is known about the history of asparagus?**
W-VG : 202. C : 113. H : 1.

2. Selecting location. — W : 271. The best plantations of asparagus are found in deep, rich, sandy loams. If the white or

blanched "grass" is to be grown, a sandy soil is almost indispensable. However, markets do not demand white shoots as much as they did years ago. The green product is now preferred by most markets as well as by the great majority of consumers. It is possible, then, to grow excellent asparagus in any soil that is fertile enough to grow a good crop of corn. Deep, sandy loams are preferable, but if such soils are not available, use heavier types and improve them as explained in W: 271.

1. Do you have a suitable location for growing asparagus?

W-VG : 205-206. L: 195. C: 114. H: 43.

2. What is the nature of your soil?

3. What is the character of the soil in New Jersey where asparagus is grown largely for market?

4. Why is sandy soil preferable for growing "white" grass and what is meant by this term? W-VG : 211.

3. Selecting varieties. — Of the old varieties, Palmetto is decidedly the best and should be planted in preference to Conover, Colossal, or any other of the old sorts. In recent years, attention has been called to new rust-resistant strains of superior merit, developed at the Concord Asparagus Experiment Station, Concord, Mass., and one or more of these strains should be obtained if possible. Martha Washington and Mary Washington are among the best.

1. What varieties should you plant and what are your reasons for selecting them?

W-VG : 204. H: 17-22. Bulletins, Bureau of Plant Industry, U. S. Department of Agriculture.

4. Starting the plants. — Success in growing asparagus depends very largely on our ability to obtain the best seed of the

best varieties and to grow a surplus of good plants so that we do not need to use any small or weak plants. Too much emphasis cannot be placed on the importance of planting the best stock.

Another year is required to start the plants at home but the lost time should be more than made up by increased profits. The seed should be selected from superior plants, and if such plants are not available in the neighborhood, seed should be ordered from specialists who make a business of selling high-grade seed.

Seed should be sown as early in the spring as the ground can be prepared, in good garden soil. The seeds should be dropped 2 or 3 inches apart in shallow furrows 20 inches apart. An inch of covering will be sufficient unless the soil is sandy and then 2 inches will be better. The seeds are very slow to germinate so that it is a good plan to drop radish seeds in the drills at intervals of several feet. These will soon germinate, and the young plants will mark the rows, thus enabling the use of cultivators before the asparagus plants are up. A heavy mulch of fresh horse manure placed between the rows about midsummer is very helpful in encouraging a vigorous growth of the plants.

Experiments have shown that large roots are much more productive than small ones so that it is important to grow many more roots than will be needed and then plant the strongest ones.

1. **What kind of roots pay the best?** W-VG : 208.

2. **How would you proceed to grow your own roots?**

W-VG : 208. L : 193. H : 30-36.

3. **Why is mulching with horse manure so beneficial in growing the roots?**

5. **Preparing the soil.** — W : 269. Soil preparation should be thorough. The plantation should yield satisfactory profits for a long term of years. Unusual preparation is made for the re-

markable asparagus fields of France. In the United States many growers plow down heavy clover sods in the fall of the year before the asparagus is planted. Others make large applications of stable manure. There is no question about the desirability of a liberal supply of humus. Commercial fertilizers are also employed in large amounts for this crop. Some is used before the roots are planted and later applications are made along the rows. A high-grade mixture is preferred. Nitrogen is highly essential, and phosphorus may be the limiting factor in some soils. Before the great World War potash was used in large amounts for this crop. A mixture of 200 pounds of nitrate of soda and 500 pounds of acid phosphate, scattered along the rows after the plants are up, should be highly beneficial.

1. What crops might be selected to precede asparagus? Give reasons for suggesting them.
2. What preliminary tillage operations are necessary?
3. What kind of fertilizer treatment do you recommend?
W-VG : 213.
4. Why is a liberal supply of organic matter recommended for this crop?
5. How do nitrogen, phosphorus, and potassium function in the growing of asparagus?
6. What do you know about the fertilizer treatments for this crop in California and elsewhere? H: 72-82.

6. **Planting.** — Asparagus should be planted very early in the spring. For green shoots the rows need not be more than 4 feet apart, though many growers allow more space. The plants are generally spaced 18 to 24 inches apart in the row. The usual

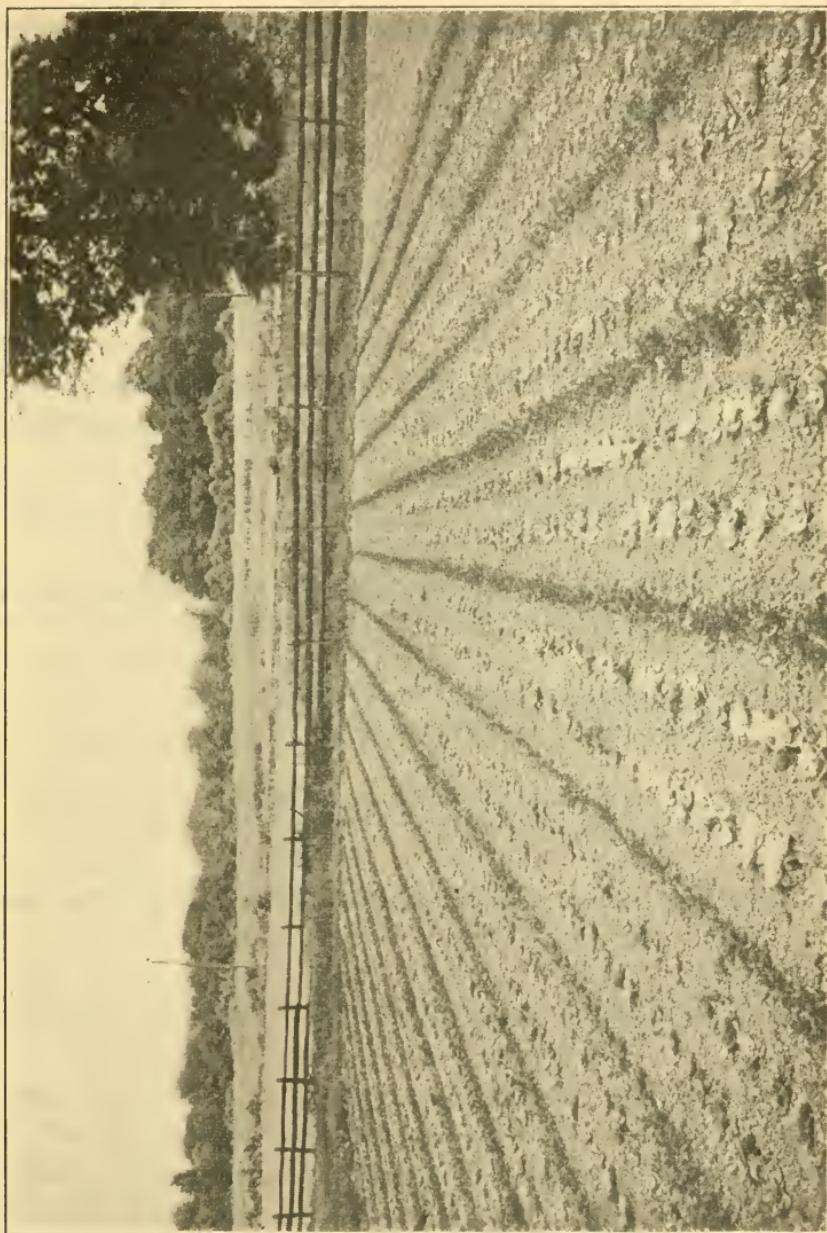


FIG. 68.—Celery intercropped with lettuce; asparagus may be intercropped in the same manner.

custom is to make furrows, about 8 inches deep, after the land has been plowed, disked, and harrowed until well prepared. It may be necessary to make two or three rounds with the plow and to use hand shovels before the furrows are deep enough. However, we should avoid turning up the subsoil. Deep planting is important because the buds of each successive year form a little higher on the crown and are soon injured by tillage tools unless roots are at good depth. The roots are covered at first with only 2 or 3 inches of soil, which is pressed firmly over the crown and fleshy roots, then more soil is filled into the trenches from time to time, after the plants are up, until the surface of the ground is level.

1. When should asparagus be planted? W-VG : 217. L : 195.
2. What are the proper planting distances to grow green shoots? W-VG : 216. C : 115, 117. H : 50-53.
3. How deep should asparagus be planted? W-VG : 217. L : 195. H : 53.
4. How and when should the furrows be filled? W-VG : 218. L : 195.
5. *What do you know about the planting distances used in other parts of the country?*
6. *What is the relation of planting distances to yield? To profits?*
7. **Cultivating.** — W : 68. The crop should have clean tillage throughout the season, or as long as it is possible to use a cultivator between the rows. Early in the spring, before cutting begins, and also at the close of the cutting season, a disk harrow may be employed to advantage in working over the entire area, regardless of rows. A small percentage of the buds in old plan-

tations will be destroyed but the benefit will far exceed the damage. If the ground becomes very weedy, it is desirable to ridge up the soil over the rows at the last cultivation after cropping has ceased and to work these ridges down in the spring.

1. How and when should asparagus plantations be cultivated?

W-VG : 218. L : 195. H : 61-71.

2. What tools are needed? W-VG : 219.

8. Combating insects and diseases. — The common asparagus beetle does much harm to the tender shoots and to the bushy plants on which both beetles and grubs feed. The blackish, spindle-shaped eggs attached to the leaves and stems attract as much attention as the strikingly marked beetles. The beetles winter under convenient shelter, and emerge in early spring when the tender asparagus tips begin to grow. Eggs laid on these shoots hatch into young grubs, which feed on the tender stalk until mature, when they enter the ground to complete the transformation. They may be controlled by clean cutting of tender shoots, by trap crops, and by poison sprays.

Rust is the only fungous disease that causes much damage to asparagus. This disease was undoubtedly introduced from Europe. It was first noted in New England about 1896. Since that time it has spread over the entire country. In the early stages there is a reddening of the tops. This is followed by a falling of the greenish, leaf-like structures, leaving the stalks bare. Late in the season blackish raised spots appear on the old stalks. These black spots contain the spores which winter over. Old tops with these blackish spots should be cut off and burned. The spears are not affected but the vitality of the plants is so lowered by the rust that the crowns become unproductive. The most effective method of combating asparagus rust is the use of resistant varieties. The Palmetto and Washington strains are very

resistant. Dusting with sulphur is effective in a dry climate like California.

1. *Why is the asparagus beetle so destructive?* CL: 203.
2. *Describe the color markings of the beetles.* CL: 201-202.
3. *Describe the grub.* CL: 203.
4. *Do parasites attack this pest?* CL: 204.
5. *What are some methods for control?* CL: 204-205.
6. *What are the symptoms by which asparagus rust may be recognized?* SH: 149-150.
7. *Why should clean culture and sanitation be practiced?*
8. *What is the most effective method of combating asparagus rust?*

9. Maintaining soil fertility. — Both the supply of organic matter and plant food must be maintained from year to year in order to obtain satisfactory crops. As a rule, stable manure, 10 tons or more to the acre, is used to keep up the supply of humus, though cover crops are employed to some extent. Part of the fertilizer is applied early in the spring and part at the close of the cutting season. It is likely that 1000 pounds annually to the acre can be profitably applied in well-managed plantations. Some of the most successful growers use double this amount. For composition see W: 271.

1. *How may the fertility of the plantation be maintained so as to secure satisfactory net returns?* W-VG: 213-216.
2. *When should the fertilizer be applied? Are you certain that any immediate benefit is derived from early spring applications in fields that are to be cut?*

10. Harvesting and marketing.—Asparagus should be cut before the shoots begin to break and form tops. In order to cut each shoot before this happens, the fields must be looked over frequently, nearly every day, when the growing conditions are most favorable. The length of the shoots will be determined largely by market demands, 7 to 10 inches, when bunched, being the most common length. Even with green shoots, a common practice is to cut the shoot 2 inches or more below the surface of the ground.

The bunches should be of the proper size to meet market requirements. They generally weigh from two to three pounds. One pound bunches are preferred by many consumers, especially when asparagus is selling at rather high prices. Asparagus should be graded, thoroughly cleaned, and the bunches tied with blue or red tape.

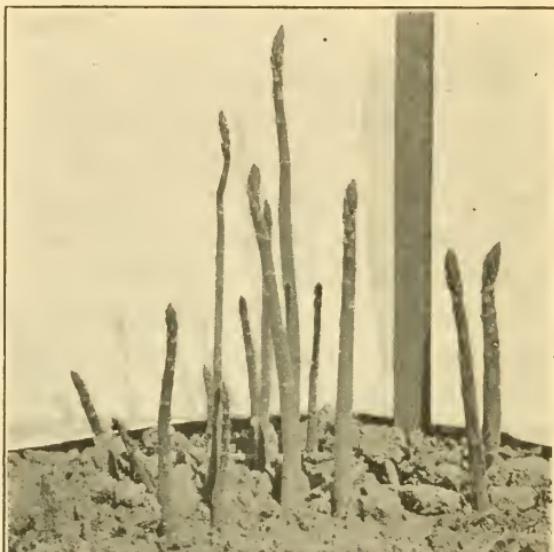


FIG. 69.—Asparagus ready to cut.

- 1. How often should the plantation be looked over for marketable shoots?** W-VG : 221. H : 85.
- 2. What should be the length of the shoots when cut for market?** W-VG : 221.
- 3. How should they be harvested and prepared for market?** W-VG : 221-223. L : 198. C : 118.

4. *How many pound bunches should be produced on an acre of land?*
W-VG : 223.

5. *What is the composition and food value of asparagus?*

Project XIX. Growing Rhubarb

Rhubarb, known also as pie plant, belongs to the buckwheat family. Rhubarb and buckwheat are the chief crop plants of this family. Dock, knotweed, and field sorrel are weeds which belong here. Rhubarb is a native of Asia.

Rhubarb is a perennial plant with a large root system and more or less woody underground stems. These underground stems are used in propagating the plant. The leaves come up from this underground shoot in the early spring, and later the shoots appear which bear the flowers. By removing the flower shoots the nourishment which would go into them is stored in the underground system, thus making more growth there. The leaves are large, heart shaped at base, and with prominent veins. The edible portions of the plant are the enlarged leaf stalks. The quality of these is best early in the spring.

Injuries to rhubarb by the rhubarb curculio are caused by feeding and egg laying in the leaf stalks. The larvæ cannot live in rhubarb owing to the unusual amount of sap, and if wild plants about rhubarb are destroyed, the opportunity for their increase will be lessened.

1. *To what family does rhubarb belong?*
2. *How many kinds of stems does the rhubarb possess?*
3. *What part of the plant is used for food purposes?*
4. *What insects affect rhubarb?* CL : 251.
5. *Why is the curculio so serious a pest?* CL : 251.

Project Outline

1. Why grow rhubarb?
2. Selecting location.
3. Selecting variety.
4. Preparing soil.
5. Planting.
6. Cultivating.
7. Maintaining fertility.
8. Forcing.
9. Harvesting and marketing.

1. Why grow rhubarb? — Rhubarb is grown in practically all home gardens. It is also produced throughout the country for commercial purposes. The crop is easily grown and pays good profits wherever a satisfactory market can be found, but the tendency is to overstock most of the markets, so that very careful consideration should be given the matter before engaging in rhubarb culture as a business proposition.

- 1. Visit your markets and ascertain whether there is a demand for rhubarb before deciding to make its culture a business project.**
- 2. Selecting location.** — W: 269. Rhubarb will thrive in any well-drained soil that is adequately supplied with humus and plant food. The soil requirements are about the same as for asparagus (W: 271).
- 3. Selecting variety.** — Two varieties are grown mainly, Victorious and Linnaeus (also called "Strawberry"). The former is more vigorous, but Linnaeus produces beautiful pink stalks that are preferred by most markets.

- 1. What variety will you select? W-VG : 420.**
- 2. What is known about the history of the rhubarb?**
W-VG : 419.

4. Preparing soil. — All that was said about preparing the soil for asparagus (W : 271) applies equally well to rhubarb.

5. Planting. — Though rhubarb may be propagated from seed, this method is seldom employed because there is such a wide variation in the character of the seedlings. The method is of doubtful value, even when the plants are wanted for forcing purposes. The usual method of propagation is by root division. After about four crops of rhubarb are harvested from a plantation, the stalks become too small to satisfy market demands and the roots are then plowed out, and often used for forcing. If desired a sufficient number of strong eyes may be saved to set the new plantation.

The propagation of this crop is an exceedingly simple matter. The roots or eyes are generally planted 3×4 or 4×4 feet apart. If planted in check rows, a horse cultivator may be used both ways, which is a great advantage. The roots should be planted in furrows opened with a plow and covered with several inches of soil. Early spring is the favorite time for planting.

1. How is rhubarb propagated? L: 199. C: 403.

2. When should it be planted? What are the proper planting distances? W-VG: 420. L: 199. C: 404.

6. Cultivating. — W : 274. Thorough tillage should be given with horse cultivators. The loss of moisture by transpiration from the enormous leaves is very great, so that the conservation of soil moisture is an important matter in growing large crops.

1. What kind of cultivation do you recommend for rhubarb? W-VG : 421.

7. Maintaining fertility. — Rhubarb plantations should receive heavy applications of stable manure every fall, supplemented by probably 1000 pounds to the acre of high-grade fertilizer, applied early in the spring. High fertility is essential in the production of large stalks.

1. What procedure is necessary to maintain the fertility of a rhubarb plantation? W-VG: 421. L: 200. C: 403.
2. *What is the composition of rhubarb?*

8. Forcing. — Rhubarb is forced on quite a large scale for commercial purposes. It is a very simple proposition in a hotbed, greenhouse, steam-heated frame, residence cellar, or wherever some artificial heat can be provided. For several years, the author has been forcing a few roots every year in coal ashes placed about five feet from the hot water furnace, used to heat the residence.

Roots are dug in the fall and covered with leaves or other litter until wanted for forcing. Then they are exposed to freezing weather for a few days. About two inches of either hard or soft coal ashes are placed on the cellar floor and the roots set on the ashes as closely together as possible. Additional ashes are worked into the spaces between the roots which are covered to the depth of about two inches. The bed is then soaked with water. After the leaf blades begin to appear, brown paper is placed over the bed and more water is applied at intervals of ten days or two weeks. In about thirty days the first cutting will be ready. When forced in subdued light, the leaf blades are mere rudiments and the stalks are a beautiful pink, exceedingly tender and of the best quality. The skin is so tender that it is unnecessary to peel the stalks. The stalks are harvested until the roots are exhausted, after which they are thrown away.

1. Would it pay you to force rhubarb?
2. Can you explain the principles involved in the forcing of rhubarb? W-VF: 191.

3. Explain the whole process of forcing rhubarb.

W-VF : 190-203. C : 404.

4. What do you know about the returns or profits of rhubarb forcing?

W-VF : 202.

9. Harvesting and marketing. — The stalks in the open ground plantations may be pulled as soon as they have a marketable length, and harvesting continued during the season until the plants begin to show exhaustion. They should be tied into bundles of the size desired by the market, the number of stalks ranging from a very few to about eight. Many growers use either blue or red tape to tie the bunches.

1. How do you think rhubarb should be prepared for your market?

L : 200. C : 405.

2. What does your market generally pay for rhubarb?

3. Have you any idea what an acre should produce?

CHAPTER TEN

SWEET CORN PROJECT

Okra and martynia are unimportant vegetables that may be included in the sweet corn group.

Project XX. Growing Sweet Corn

Corn is a member of the grass family. There are several thousand species of plants in this family. Here belong the cereals or grains, such as wheat, oats, barley, and rye, and the meadow and pasture grasses. Corn was being cultivated by the Indians when America was discovered and was for a long time known as Indian corn. It has also been called maize. Although not now known to exist in a wild form, it is generally believed to be a native of the warmer regions of America. It grows under cultivation in the cooler areas but is distinctly a warm climate plant.

Corn is an annual, completing its life-cycle and maturing seed during a single summer. The root system is fibrous, and although the upper roots are near the surface, the lowermost roots finally reach a considerable depth, possibly three feet or even more. In addition to the ordinary roots, corn plants often develop "prop" or "brace" roots from the nodes just above the surface.

Corn is such a large plant that one scarcely thinks of it as belonging with the grasses. There is considerable variation in the height of the stems. Some of the dwarf varieties are less than three feet in height, while some forms reach a height of fifteen feet. The stem is jointed and filled with pith. "Suckers" or branches often arise from the lower joints, but they are considered undesirable as they absorb considerable nourishment but are not usually

fruitful. The leaves arise in a true grass-like manner and consist of two parts, the blade, and the sheath that envelops the stem. The leaf blades have a special structure which enables them to roll up under dry conditions when the plant is not receiving sufficient water. By rolling up, the evaporation of water is retarded. When supplied with sufficient water the leaves flatten out.

Corn plants have two types of flowers, the pollen-bearing ones being in clusters at the top known as the "tassel," and the fruit-and seed-developing flowers borne in dense clusters or spikes in the axils of leaves lower down on the stem. This cluster of flowers when matured into fruit becomes the "ear." The pollen-receiving organs on the young ears are spoken of as "silks." Cross-pollination, *i.e.* the transfer of pollen from the tassel of one plant to the silks of another, produces the best yields. Wind and gravity are the chief agents in distributing the pollen. If pollen from a different strain happens to be brought to the silks, crossing will occur which may result in new characters appearing at once. If crossing is not desired, different strains must not be grown in adjoining plots.

All cultivated corn is regarded as one species, but there are several sub-groups or sub-species such as flint corn, dent corn, pop corn, and sweet corn.

1. *To what family does corn belong?*
2. *Of what region is corn supposed to be a native?*
3. *What sort of root system does the corn plant develop?*
4. *What are "suckers"? Are they desirable?*
5. *How can you tell when corn plants are not obtaining enough water?*

6. *What do you understand to be the relation of cross-pollination to yield?*
7. *If field corn and sweet corn grow in adjoining fields, would there be any noticeable effect upon the ripening of the ear?*

Project Outline

1. Why grow sweet corn?
2. Selecting location.
3. Choosing varieties.
4. Preparing soil.
5. Planting.
6. Starting early plants.
7. Cultivating.
8. Suckering.
9. Combating insects.
10. Harvesting and marketing.

1. Why grow sweet corn?—The growing of sweet corn for commercial purposes appeals to gardeners who are well equipped with land, horses, and the larger tillage implements, and who have easily accessible markets that are not fully supplied with this vegetable. Gross receipts of \$150 to \$300 an acre are possible, and with good management net profits should be very satisfactory. There is an increasing demand for sweet corn of the highest quality, and excellent prices can generally be obtained for ears of the best varieties, such as Golden Bantam, marketed at the proper stage of ripeness.

- 1. Do you have the proper facilities for the growing of sweet corn for commercial purposes?**
- 2. Do you think sweet corn will pay you as well as some other crops?**

3. Is your market well supplied with this vegetable?

4. How can the fodder be utilized to best advantage?

W-VG : 434. Wi : 186.

5. What is the history of sweet corn? Wi : 3-7.

6. What is the botany of this plant? Wi : 1. W : 283.

7. What do you know about the sweet corn canning industry of the United States? Wi : 158-185.

2. Selecting location.—W : 40. Excellent sweet corn may be grown in any soil that will produce a good crop of field corn. Southern or southeastern exposures and sandy soils are favorable to an early crop. The heaviest yields are obtained in sandy or clay loams which abound in plant food and organic matter. A heavy clover sod, plowed down late in the fall or early in the spring, provides ideal conditions for the growing of sweet corn. Thorough soil drainage is always essential.

1. What is the most favorable location for the production of a very early crop of sweet corn? Do you have such a location?
Wi : 45.

2. How does sweet corn compare with field corn in the requirements of the location? C : 225.

3. Why is good soil drainage essential for sweet corn?

3. Choosing varieties.—There are many excellent varieties of sweet corn. Adams Early is very hardy and extremely early. It is not a sweet corn at all, but really a white dent corn. This variety may be planted at least ten days earlier than the usual sweet varieties. White Cob Cory is an excellent early sweet corn closely followed by Howling Mob.

Golden Bantam is a universal favorite because of its very superior quality. Many growers specialize with this variety and make successive plantings so as to have marketable ears from July until destructive frosts occur in the fall. Thousands of consumers now recognize this variety as the leader in quality.

Country Gentleman and Stowell's Evergreen are the most extensively grown late varieties. Both are very prolific and make a large amount of fodder.

1. What varieties of sweet corn do you think will pay you best?

W-VG : 430-431. Wi : 33.

2. How may varieties of sweet corn be classified?

W-VG : 430-431. Wi : 35-37.

3. How does sweet corn vary in quality? Name varieties representing the different degrees of quality.

4. What varieties are grown most largely for the canning industry?

W-VG : 431.

4. Preparing soil. — Soil that has been properly prepared for early cabbage (W : 99) will be satisfactory for the growing of sweet corn. As previously indicated (W : 286) heavy sod land should be plowed late in the fall or early in the spring. This crop responds to the liberal application of both stable manure and commercial fertilizers. When clover sod or leguminous crops have been plowed down, the fertilizer treatment may be restricted to commercial plant foods. Stable manures will probably be found especially valuable in soils that are thought to be deficient in organic matter.

1. When should your soil be plowed for sweet corn?

2. Do you think you should apply stable manure? If so, how much? W-VG : 432. C : 224. Wi : 11.

3. Will you need commercial fertilizer to make your crop a success? What kind and how much? W-VG : 432.
4. Prepare a statement of the various manures and fertilizers you will need.

5. **Planting.** — In the production of a profitable crop of sweet corn, early planting is generally an important factor. Some growers place so much emphasis on early planting that they take considerable risk of the seed rotting because of a cold soil and the plants being killed by spring frosts. If the first planting is lost, it is a simple matter to make a second. In most parts of the North sweet corn may be planted with comparative safety between May 1 and May 10. Subsequent plantings should be made at intervals of two weeks until July, provided the season is long enough for the ears to reach the roasting ear stage from the latest plantings.

Though the crop is often grown in hills, it is more economical to plant in drills with a seed drill, the spacing of which will depend mainly on the height or vigor of the varieties to be grown. For tall sorts, such as Stowell's Evergreen, the rows should be about three and one-half feet apart and the plants about a foot apart in the row. Early varieties may be planted in rows three feet apart or closer and the plants do not need so much space in the rows. Sweet corn is generally covered with about two inches of soil, but the earliest plantings should not be covered with more than an inch.

1. When should sweet corn be planted in your community?
2. To what extent should the date of planting be regulated by the variety used?
3. What are the proper planting distances for the variety you have selected? W-VG : 433. C : 225. Wi : 19.
4. How deep should the seed be covered? Wi : 19.

6. Starting early plants. — W: 46. Some market gardeners have found it profitable to start part of the plants under glass. A cold frame will serve the purpose very well. Perhaps it is never desirable to plant the seed more than three weeks in advance of setting the plants in the open ground. Three-inch paper pots, filled with good soil, are satisfactory. About six grains of corn should be planted in each pot, and then the plants should be thinned to three or four, and at the proper time each pot of plants planted in the field or garden to make a hill.

1. Explain the details of starting sweet corn under glass.

W-VG : 432.

2. How much time do you think would be gained in starting the plants under glass?

3. Do you think it would pay you to use this method?

7. Cultivating. — Corn should have thorough cultivation until it is impossible to drive between the rows with a horse. Any crusts formed on the surface of the ground before the plants are up should be broken by the use of a horse-drawn weeder. Some hand hoeing may be necessary to keep the plot free from weeds. A top dressing with nitrate of soda when the plants are a foot or two high is common practice.

1. What implements will you need to cultivate your sweet corn?

2. Give explicit directions for the use of the weeder and cultivator for this crop. Wi: 23-25.

8. Suckering. — Some varieties of sweet corn produce a great many shoots or suckers about the main stalk. There is no question about their interfering more or less with the development of large ears, and for this reason it pays to remove them as soon as possible after their appearance. Wi: 25, 72, 182.

9. Combating insects and diseases.—A number of insects attack sweet corn, such as wire worms, white grubs, or sod worms, destroying young plants soon after germination. Lice or other sucking insects, or climbing caterpillars, among which are army worms, the corn earworm, and stalk borers, cause much injury in some seasons.



FIG. 70.—Corn root web worm; work on young corn.

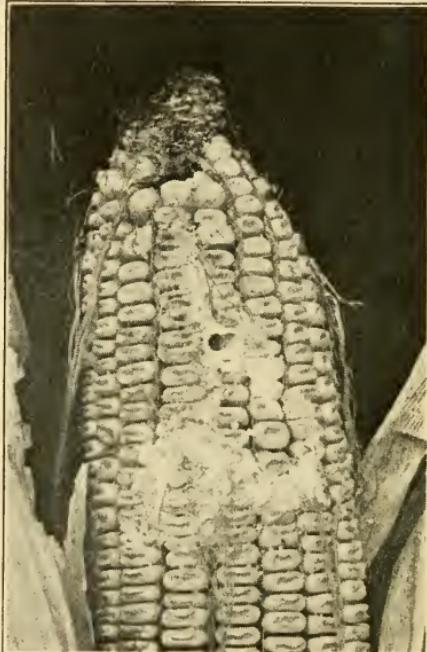


FIG. 71.—Injury by corn earworm.

The corn earworm is probably the most important insect enemy of sweet corn. It will live on almost any vegetable crop, but has a particular liking for tomatoes. Injuries are caused by the dull greenish or brown striped caterpillars which hatch from eggs deposited in the corn silk and gradually work through into the ear, feeding first on the outer kernels and later probably damaging a large portion of the ear. Control measures suggested are dusting, early planting, and spraying of tomatoes.

Smut is the most widespread and destructive disease of sweet corn. It is responsible for enormous annual losses to field corn. Stems, leaves, tassels, and ears are attacked by the fungus. The first signs are swellings covered with a whitish, glistening membrane. Later the swellings break open and expose blackish, powdery masses of spores. Corn smut is a difficult disease to control. Removal of the smut masses tends to reduce the amount of damage. They should be destroyed by burning. A thick stand of corn is most liable to be smutted because crowding interferes with circulation of air among the plants and produces humid conditions favoring infection.

1. *What is the range of the corn ear-worm in the United States?*
CL: 212.
2. *Name the common vegetables eaten by this pest.* CL: 212.
3. *What is the feeding habit of the corn ear-worm?* CL: 215-216.
4. *Describe fully several control practices.* CL: 217-218.
5. *What are some other important sweet-corn insects?*
CL: 218, 222, 225, 227, 228, 229, 233.
6. *How may developing corn smut be recognized?* SH: 284.
7. *What measures may be practiced to reduce the injury from smut?*
SH: 286.
10. **Harvesting and marketing.**—The quality of sweet corn depends very largely upon the stage of maturity when the ears are pulled. The kernels should be plump and tender. If underripe, flavor is lacking; if over-ripe, the hard kernels are objectionable as human food. Experience can soon be acquired which will enable one to pull practically all the ears at the proper time without examining the kernels of each ear.

Sweet corn is sold by the dozen, or by the hundred ears, and sometimes by weight and measure. Various styles of hampers and crates are used for shipping the crop.

1. To what extent is the quality of sweet corn determined by the stage of maturity when the ears are pulled? C:336. Wi:31.
2. What is the best package for the marketing of your crop? How many packages will you need?

CHAPTER ELEVEN

THE HOME GARDEN PROJECT

The World War emphasized the importance of the home garden. It has made large contributions to the nation's food supply. Never before have our people, as a nation, so fully realized the possibilities of materially adding to our food supply through the cultivation of thousands of small home plots.

Project XXI. Making the Home Garden

1. Why have a home garden?
2. Selecting location.
3. When to plant.
4. What to plant.
5. How much to plant.
6. Making garden plans.
7. Obtaining seed.
8. Making germination tests.
9. Starting early plants.
10. Selecting tools.
11. Preparing soil.
12. Planting.
13. Cultivating.
14. Hoeing.
15. Weeding.
16. Thinning.
17. Combating insects and diseases.
18. Harvesting the crops.
19. Storing the late crops.

1. Why have a home garden? — A great many people who like to grow vegetables do not care to produce them for commercial purposes. This is true of many students and members of boys' and girls' clubs. Then, why not make a home garden — the best in your community? It is quite unnecessary to produce arguments in favor of home gardening. Who doesn't prefer vegetables from his own plot and produced by his own labor, to the ones that are available at the public markets? Health, pleasure, and perhaps profit are the rewards of the diligent gardener. It is natural for all members of the family, old and young, to be interested in a well-planned and well-kept vegetable garden. As a real project for students, club members, and home keepers, it offers many inducements. No farmer should consider his farm complete without a garden ample for the year-around needs of his family. Not only will his table be more attractive in summer with such a garden, but there will be a surplus for canning and winter storage, and the health of his family will be greatly improved by the better-balanced diet thus made possible.

1. Will it pay you to make a home garden instead of undertaking a commercial gardening project?

2. What are the benefits and advantages of home gardens?

2. Selecting location. — It often happens, especially in cities and villages, that there can be no choice of location, for the garden must be made on whatever ground is available. In the open country, however, where it is generally possible to select areas that are the best adapted to this important purpose, the following factors should have consideration :

1. The plot should be located as conveniently as possible to the residence. This is especially important when the garden makers must also attend to most of the household duties.

2. Sandy loams provide the best conditions for the growing

of the various classes of vegetables, especially the root crops. However, almost any soil may be treated so as to produce good vegetables. W: 305.

3. Southern or southeastern exposures are best, because they are warmer and produce earlier crops.

4. Good soil drainage is absolutely essential. If there is any question about this matter, the soil should be properly tile-drained.

5. A full amount of sunshine is necessary for the best results. Buildings and trees that would shade the garden should be avoided as much as possible.

1. What are the ideal soil conditions for a home garden?
2. What other factors should be considered in selecting a location?
3. Give as minute description as possible of the soil that you will use.

3. When to plant. — The home garden planting table on the last page of this book will be found very useful in determining the date when each vegetable should be planted. To Mr. John R. Bechtel of The Pennsylvania State College is due the credit for this table, which appears in Extension Circular No. 76. The dates given are for Pennsylvania, but they apply equally well to most parts of the North. Vegetables may be classified into four groups, according to their temperature requirements. The groups are described and listed as follows by Mr. Bechtel:

1. "Very hardy" crops include the vegetables that are not injured by severe midwinter freezing, such as asparagus, horseradish, parsnip, rhubarb, salsify, and the winter onion.

2. "Hardy" crops thrive during cool weather, and will withstand the frosts of spring and early fall, but not severe freezing. Such crops are cabbage, cauliflower, beet, carrot, turnips, lettuce, endive, onion, pea, radish, and spinach. All crops falling in

classes one and two may be planted with safety as early in the spring as the ground can be prepared.

3. "Tender" crops are those which are quickly injured by frost — such as snap beans, sweet corn, cucumber, squash, and tomato.

4. "Very tender" crops are those that may be injured by continued cool weather without frost. They should not be planted until the ground has become warm, usually about May 20 to June 10. Such crops are lima bean, eggplant, muskmelon, and pepper.

1. How are vegetables classified according to temperature requirements?
2. What are the vegetables in the several groups?
3. When do you think each vegetable should be planted in your section?
4. Ascertain as many dates as possible of killing spring frosts in your neighborhood.

4. **What to plant.**— There are three main considerations in determining what to plant in the home garden. Family preferences should have first thought. It is folly to grow any considerable quantity of vegetables that are not popular on the home table. We should produce an abundance of those for which there is a lively home demand. Second, the food value of the various kinds of vegetables should have special consideration in these times of high food prices. For example, meats are very expensive and it is easily possible to reduce the cash outlay for protein foods, including meats, fish, and eggs, by growing peas and beans, which have a large protein content. At the same time there should be a complete list of the salad plants and other vegetables that are composed mainly of the carbohydrates. Those which are rich in the vitamines should also have consideration. Third, we should strive

to make such plantings as will provide vegetables for every month of the year. Too often the tendency is to make liberal plantings of the classes that are edible during the summer and fall months, but cannot be stored or preserved for winter consumption. Too much

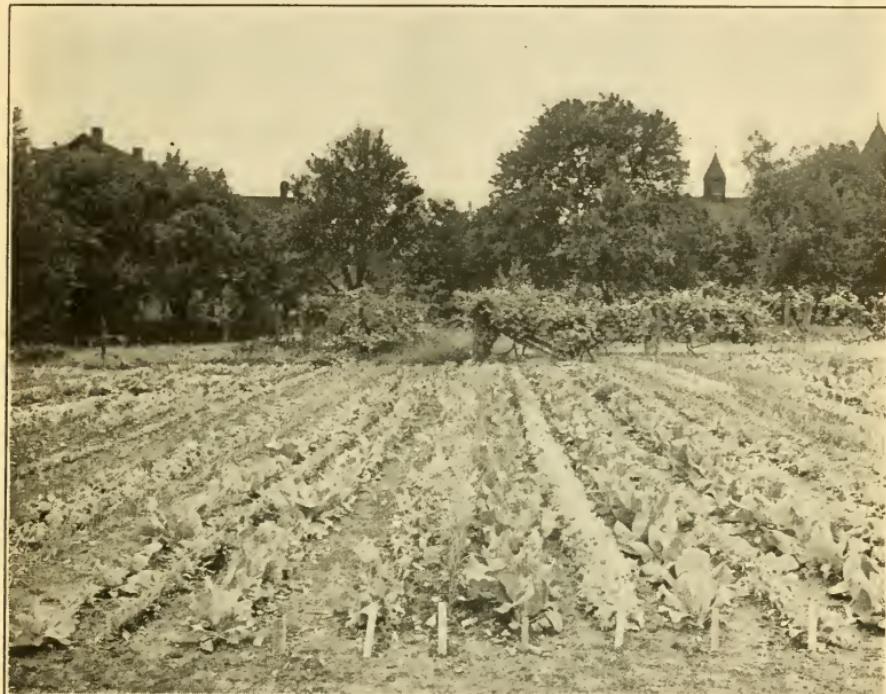


FIG. 72.—A student garden showing various combinations of companion cropping.

thought cannot be given the whole problem of what to plant to meet fully the requirements of the family.

1. **What are the main considerations in determining what vegetables to plant in the home garden?**
2. **How do vegetables differ in their composition and food values?**
5. **How much to plant.** — This is always a perplexing problem to the inexperienced gardener, and often to those who have had con-

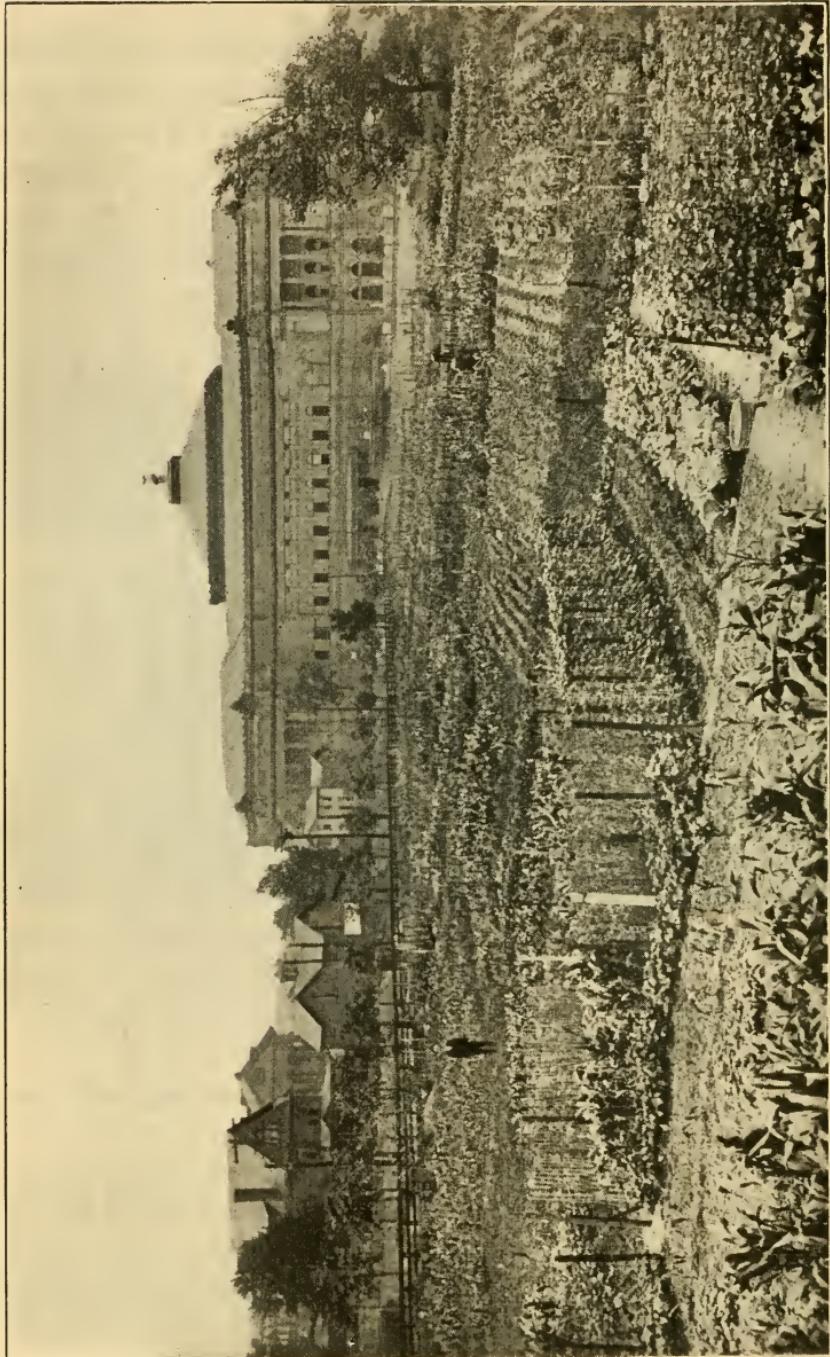


FIG. 73.—A city war garden which shows how space may be economized in home gardens by training the tomatoes to stakes.

siderable experience. In most garden operations the tendency is to plant too largely of certain vegetables, which generally results in the waste of plant food, labor, and a portion of the crops. Most home gardeners plant more of the early crops, as lettuce and radishes, than can be utilized, and there is usually a shortage of the vegetables that are valuable for winter storage such as celery and the root crops. A very careful study should be made of the family requirements and the planting made accordingly. The following table, prepared by Mr. Bechtel, gives the estimated requirements for a family of five and also the approximate yield of small plantings:

ESTIMATED REQUIREMENTS OF A FAMILY OF FIVE

CROP	NO. FEET OF ROW	APPROXIMATE YIELD FROM 100-FT. ROW
Asparagus	100 ft.	100 lb.
Bush bean (4 plantings) .	50 ft. each planting	1½ bu. (pods)
Bush lima (1 planting) .	400 ft.	15 qts. (shelled)
Beet	75 ft. early, 100 ft. late	2 bu.
Cabbage	50 ft. early, 100 ft. late	50 heads
Carrot	50 ft. early, 100 ft. late	2 bu.
Cauliflower, late	50 ft.	50 heads
Celery	50 ft. early, 100 ft. late	200 stalks
Chard	10 ft. . . . .	.
Chicory	100 ft.	2½ bu. (roots)
Chinese cabbage	25 ft.	100 heads
Chive	5 ft. . . . .	.
Corn (6 plantings)	50 hills each	8 doz.
Cucumber	10 hills	1½ bu.
Egg plant	40 ft.	150 fruit
Horseradish	15 ft.	70 lb.
Kale	20 ft.	3 bu.
Kohlrabi	25 ft. early, 50 ft. late . . . . .	.
Lettuce	50 ft. . . . .	.
Muskmelon	10 hills	60 fruits
New Zealand spinach	10 ft. . . . .	.
Onion (sets) green	100 ft. . . . .	.
Onion (sets or seed) mature .	100 ft.	1½ bu.
Parsley	5 ft. . . . .	.

CROP	NO. FEET OF ROW	APPROXIMATE YIELD FROM 100-FT. ROW
Parsnip	40 ft.	3 bu.
Peas	300 ft. (more for canning)	2 bu. (pods)
Pepper	25 ft.	400 fruit
Potato	100 ft. early, 1400 ft (1/10 A) late . . .	1½ bu.
Radish	150 ft. . . . .	.
Rhubarb	15 ft. . . . .	.
Rutabaga	100 ft.	2 bu.
Salsify	100 ft.	2 bu.
Spinach	50 ft. at each of 3 plantings	2½ bu.
Squash	8 hills summer, 10 hills late . . . . .	.
Tomato	50 plants (enough . . . for canning) . . .	{ 10 bu. (staked) or 6 bu. (not staked)
Turnip	50 ft. early, 100 ft. late	2 bu.

1. What will be the requirements of each crop for the family which you will supply? (This question should be worked out in as much detail as possible.)

6. Making garden plans. — We cannot hope to have satisfactory home gardens without making careful plans. The plans should be developed during the winter and then there should be no delay and very few mistakes in starting the real operations the following spring.

The following fundamentals should have consideration in the development of home garden plans.

1. The vegetables should be planted in straight rows to facilitate cultivating with a wheel hoe.

2. Perennial crops like rhubarb, asparagus, and horse radish should be planted along one side of the garden, so that they will not interfere with the planting of the annual crops.

3. The early, quickly maturing crops, as radishes, lettuce, bunch onions, etc., should be planted in a strip at one side of the garden, perhaps next to the perennial vegetables, where they can be followed by later crops, and the remainder of the garden prepared and planted at the proper time.

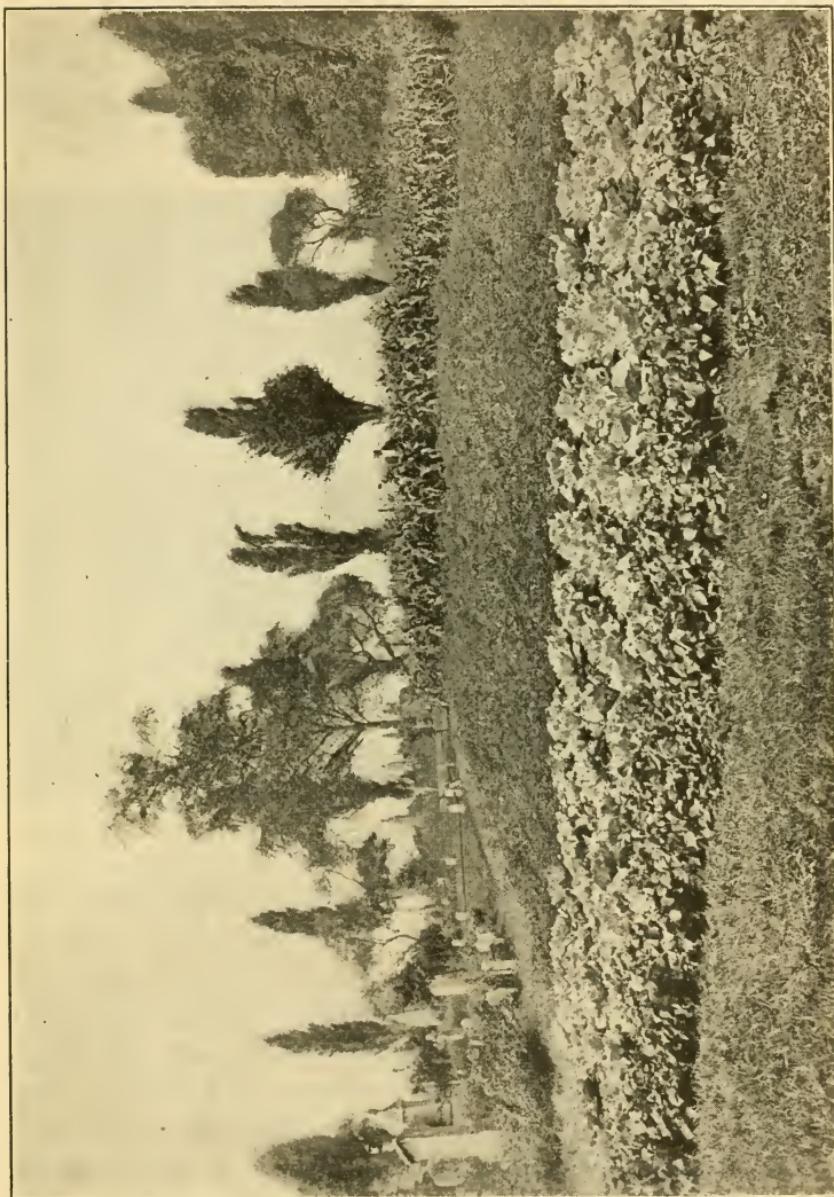


FIG. 74.—A productive war garden.

4. The tall plants, as corn and peas, should be placed so that they will not shade the other crops.

5. It is necessary to practice companion and succession cropping in order to utilize all of the ground to the best advantage. Satisfactory plans for the economical use of the soil throughout the

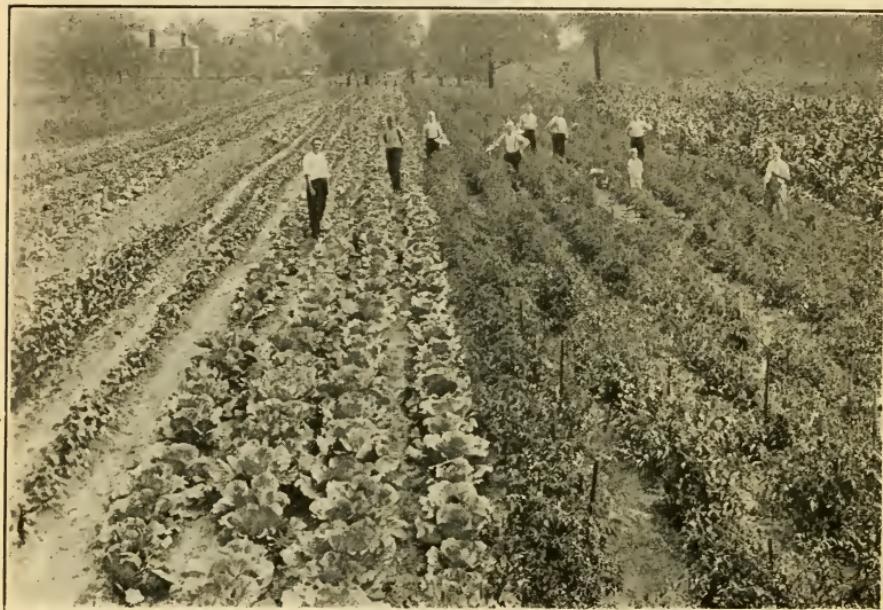


FIG. 75.—A well-managed war garden. There are no vacancies in this garden.

season cannot be made without a thorough knowledge of the plants to be grown, with special reference to their habit of growth and time of maturity.

There is no model plan that is equally suitable for all home gardens. Every plan should be prepared with a view of getting the best results for the family to be supplied. It is believed, however, that the plans, prepared by Mr. Bechtel, and published in Extension Circular No. 76 of The Pennsylvania State College, will be found exceedingly helpful, especially to those who have had little experience as garden makers. See page 299.

1. What are the most important fundamental considerations in the making of garden plans?
2. What should you know about plants, their habits of growth, temperature requirements, and time of maturity?
3. Make a plan of the garden which you will plant. Be original, but be certain you are right in the placing of each vegetable.

7. Obtaining seed. — The utmost care should be exercised in obtaining seed for the home garden. There may be specialists in the community who could spare a little seed of their choice strains. It is often possible to procure seed of superior quality from well-known specialists in other parts of the country. When ordered by catalogue, we should be certain that we are patronizing a reliable house that will send good seed of the varieties wanted.

1. Where will you obtain the seeds required for your home project?
2. Prepare a complete list of the seeds required and determine their cost.
3. Order seeds as early as possible after the new catalogues are received. Early orders are more likely to be filled with the best seed.

8. Making germination tests. — It is a simple matter to make a germination test of the seeds to be planted. This may be done by counting and planting twenty to one hundred seeds of each lot in a box placed in a warm, sunny window. If preferred, the seeds may be placed between blotters that are kept moist, or in a strip of cloth that is rolled up and tied and then dipped in warm water, more water being added whenever it is necessary in order to keep the cloth moist. If the seeds are kept in a warm place they will

soon sprout, when the viable ones may be counted and the percentage of germination determined.

1. Make a germination test of the seeds you will plant, give a written explanation of the method employed and a report of the results.
9. Starting early plants.—It is impossible to produce the earliest crops of cabbage, cauliflower, tomatoes, peppers, egg-



FIG. 76.—A community display of vegetables.

plant, lettuce, celery, and a few other vegetables of minor importance without starting the plants under glass. A hotbed, which later may be used as a cold frame, will serve the purpose very well. Instructions regarding hotbed construction and the various phases of starting plants under glass may be found in W: 44.

1. What equipment will you need to start your plants under glass?

2. When should each kind of vegetable be sown?
3. How much seed will you need to sow of each kind that should be started under glass?
4. When should the seedlings be transplanted into the cold frame and how much space will they need?
5. What do you know about the hardening of plants? W: 63.

10. Selecting tools. — Comparatively little time is required to make and maintain a good garden if you have the proper tools, and the pleasure derived will depend very largely upon this factor. In too many instances a spading fork or shovel, hoe, rake, and line constitute the entire equipment. In addition to these tools there should be perhaps two or three styles of hoes, besides a trowel, dibber, hand weeders, labels, and by all means a good single or double-wheel hoe. With a wheel hoe one can cultivate a large garden in a remarkably short period as compared with the time that is necessary to cover the same area with an ordinary hoe. A hand sprayer may be needed and a hose and sprinkling can are always useful.

1. What tools will you need for your garden and what will they cost? How are they used?

11. Preparing soil. — The preparation of the home garden soil should be as nearly perfect as possible. Large results will be expected from this intensively farmed area. There should be, therefore, no uncertainty about the soil being as good as it is possible to have it. Drain it if necessary. Then apply lime, stable manure, and commercial fertilizer in the proper amounts. Be thorough. W: 63.

12. Planting. — When the proper date arrives for planting and the soil is well prepared and contains the right degree of moisture,

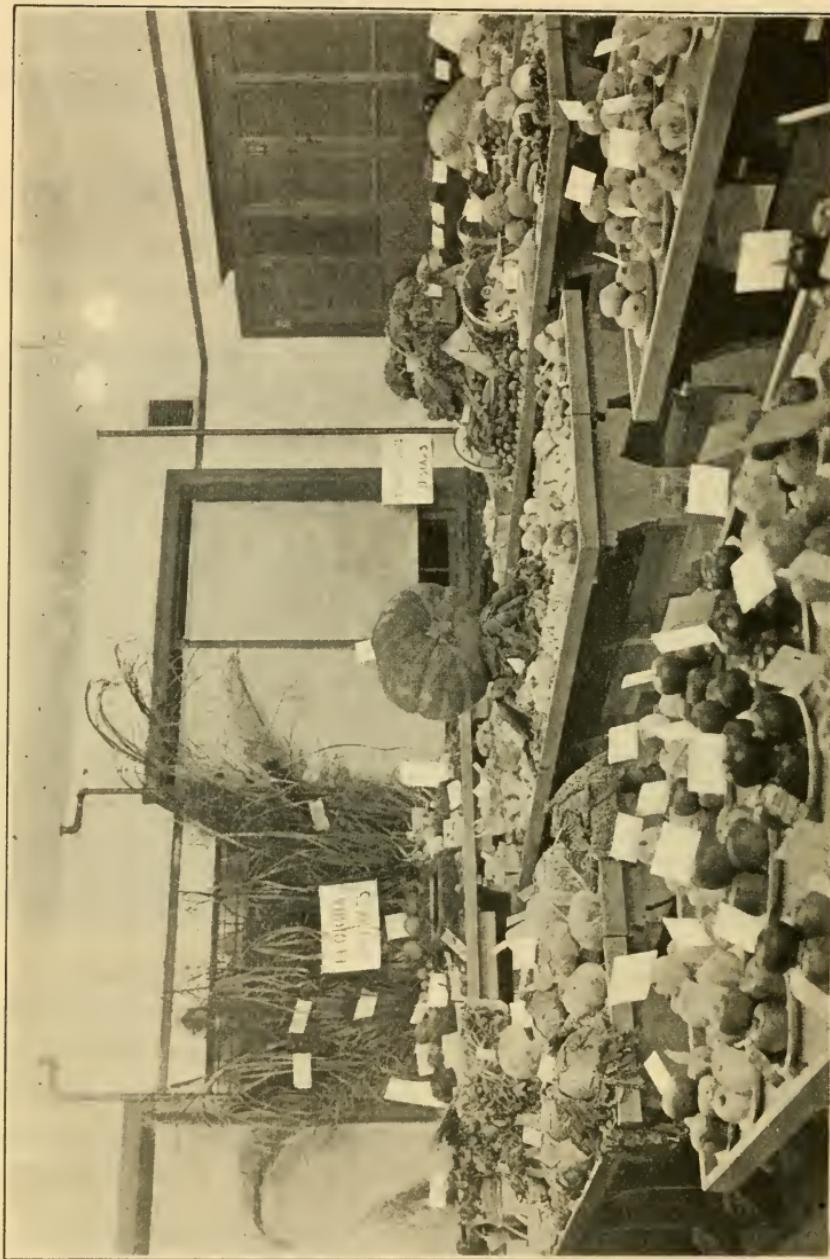


FIG. 77. — There is no reason why the fruits of a community should not be exhibited with the vegetables.

no time should be lost. Promptness in planting is an exceedingly important factor in garden making. Because of late plantings, thousands of families do not have vegetables from their own gardens as early as they should.

13. Cultivating. — Clean tillage is one of the secrets of a successful garden. As previously indicated (W:68) it conserves soil moisture besides serving several other very useful purposes. The wheel hoe should be used as often as necessary to keep the surface of the soil fine and loose.

1. How soon should the garden be cultivated after a heavy rain?
2. How deep do you think your garden should be cultivated?
3. How long will it take you to cultivate your garden with a wheel hoe? With a hand hoe?

14. Hoeing. — Though the garden is cultivated regularly and thoroughly with a wheel hoe, more or less hand hoeing is usually necessary to destroy weeds in the rows, and also to maintain a fine, loose soil over the entire garden area. It is desirable to have several types of hoes, if possible, such as a hillng hoe with a five- or six-inch blade, a two-pronged hoe with a narrow cutting blade, a hoe with a broad cutting blade and six or eight rake-like teeth, and a scuffle hoe.

15. Weeding. — With small plants, such as onions, beets, radishes, lettuce, parsnips, and parsley, weeds often appear in the rows close to the plants where it is impossible to remove many of them with either the wheel hoe or a hand hoe. In this case we must use a small hand weeder — there are various types of hand weeders — and perhaps pull by hand some of the weeds which are difficult to remove with any tool. However, if the soil has been properly managed and the ground thoroughly cultivated, the labor of weeding will be very slight.

1. What hand weeders do you think are most useful?

16. Thinning. — Vegetables like onions, radishes, lettuce, beets, and carrots generally require some thinning to prevent crowding and to give each plant the space it needs to attain full development. This operation should have attention as soon as possible after all the plants are up. The hand weeder may be used for this purpose, removing weeds at the same time.

1. What should be the spacing of the vegetables that generally require thinning?

17. Combating insects and diseases. — The home gardener should be constantly alert for enemies that may appear suddenly

and cause great harm before their ravages are checked. He should be well informed regarding the nature of the various plant pests, and take precautionary measures as much as possible. Consult spray calendars.

The back yard garden seems to be the rendezvous for insect pests. Accumulations of refuse, decaying board walks, humid



FIG. 78.—Wire worm.

hiding places, or untrimmed bushes, all provide conditions favorable to hibernation or unarrested development of insect life. Control for these pests is difficult, owing to lack of proper spraying apparatus, but in some instances, as already pointed out, practices may be followed in the home garden which would be impracticable in larger plantings. Often a home-made apparatus will be satisfactory if only a few plants are considered, and here also dusting or proprietary commercial spray materials may be more usable than the standard sprays. Keeping rubbish from accumulating about the garden is one

of the most valuable preventatives of insect attacks in small plantings.

The following pests are particularly troublesome in small gardens, and for convenience of the student are discussed under this caption :

Cut-worms (various species) : Plants set in the field sometimes wilt or are entirely cut off at the surface of the ground. Upon removing the soil just at the base of the plant, a dirty-colored, naked caterpillar is found. This is a cut-worm, named from its usual habit and one of the most troublesome pests of the garden. Cut-worms are the younger stages of moths which are active only at night. The adults are active in July and August, laying eggs in fields grown to weeds of any kind. Worms hatch from these eggs, and feed for a few weeks in the fall, then pass the winter in the soil. In the spring, they become active and resume feeding on the first green plants. The following methods of control are suggested: In large areas, free cultivation in summer, fall plowing, early spring cultivation, poison mash.



FIG. 79.—Millipede.

White grubs : These larvae of the common June beetle are the large white grubs that are often found curled up in the ground at the base of a plant. The female deposits eggs in the old sod ground, preferably where the grubs can feed on the grass roots during the three or more years necessary to complete its life cycle. Consequently crops grown on newly plowed sod ground are most likely to be attacked. Crop rotation is a means of control.

Wire worms : These insects work within the soil, feeding on newly sprouting seeds, or on root crops, or tubers. They are more troublesome in newly plowed sod land, owing probably to the fact that the larvae live in sod land during the three- to six-year life

cycle. Wire worms are long, hard-bodied, yellow or brownish larvæ, the adults of which are the well-known snapping beetles. They may be controlled by crop rotation, and poison baits.

Millipedes: Recently germinated corn and other seeds, and fruits, if resting on the ground, may be destroyed or spoiled by a rather long, round segmented animal, having two pairs of legs on all but the four front segments. No satisfactory method of control is known. Trapping or dusting is sometimes effective.

Slugs: Radishes, lettuce, cabbage, beans, and various root crops are often spoiled by a grayish spotted slug having on its body a slimy protective covering that adheres to the surface on which it travels. These pests appear to prefer moist locations especially, seeking hiding places beneath stones or decaying wood, away from strong sunlight. As the drying of the slimy coat will kill them, an application of air-slaked lime on and about the plants is suggested. Poison bait or poisoned tubers used as traps are efficient.

Information on control of diseases of vegetables will be found in the various chapters in connection with the notes on "Combating Insects and Diseases."

1. What causes plants to wilt and to be cut off at the ground? CL: 260.
2. What is the life history and habit of a cut-worm? CL: 260.
3. Which is the best remedy, culture or trapping? CL: 298.
4. When are white grubs most injurious? CL: 346.
5. What is the life history of the white grub? CL: 345-346.
6. Can any crops be safely grown on infested land? CL: 346.
7. Can broods of the insect be anticipated? CL: 347.

8. Give a control practice. CL: 346-347.
9. What is the life history of a wire worm? CL: 347-348.
10. Name several species and describe their work. CL: 348-350.
11. How do wire worms work? CL: 347.
12. Give several control measures. CL: 350.
13. What is a good crop rotation? CL: 350.
14. How do millipedes differ from wire worms? CL: 342, 347.
15. Describe the work of millipedes. CL: 342, 344.
16. How does a snail eat? What is its appearance? What is its life history? CL: 354-355.
17. Name several vegetables attacked by insects and describe the injury. Give several satisfactory remedies.
CL: 356, 357.
18. **Harvesting the crop.** — The highest quality in most vegetables cannot be obtained unless the crops are harvested at the proper time. This is especially true of the root crops, peas, beans, tomatoes, cucumbers, melons, and sweet corn.
 1. What is the proper time to harvest each class of vegetables which you will grow in your home garden?
19. **Storing the late crop.** — The successful storage of late crops is an important part of the home gardening operations. A great diversity of methods may be employed. W: 197.

HOME GARDEN

VEGETABLES	SEEDS REQUIRED	LONGEVITY OF SEED YEARS	ROWS APART HAND CULTIVATION	ROWS APART HORSE CULTIVATION
Asparagus	1 yr. old roots	3-5	42-48 in.	42-48 in.
Bean (snap)	1 pt. — 100 ft.	2-3	18-24 in.	24-36 in.
Bean (dry shell)	$\frac{1}{2}$ -1 pt. — 100 ft.	2-3	20-24 in.	24-36 in.
Bean (pole)	$\frac{1}{2}$ pt. — 100 ft.	2-3	36 in.	36-48 in.
Bean (bush lima)	1 pt. — 100 ft.	2	18-30 in.	30-36 in.
Bean (pole lima)	1 pt. — 150 ft.	2	30-36 in.	36-48 in.
Beet	1 oz. — 75 ft.	4-6	12-18 in.	24-28 in.
Cabbage (early)	1 oz. — 5,000 plants	4-5	20-28 in.	24-30 in.
Cabbage (late)	1 oz. — 300 ft.	4-5	24-32 in.	36-42 in.
Cabbage (Chinese)	1 oz. — 300 ft.	4-5	18-24 in.	24-28 in.
Carrot	1 oz. — 400 ft.	2-3	12-18 in.	24-28 in.
Cauliflower	1 oz. — 5,000 plants	4-5	24-30 in.	36-42 in.
Celery	1 oz. — 8,000 plants	3-5	20-24 in.	24-48 in.
Chicory	1 oz. — 300 ft.	5-6	12-18 in.	24-28 in.
Corn (sweet)	1 pt. — 300 hills	2	30-36 in.	36-42 in.
Cucumber	1 oz. — 50 hills	5-10	4- 5 ft.	4- 5 ft.
Eggplant	1 oz. — 2,000 plants	3-5	24 in.	30-36 in.
Endive	1 oz. — 400 ft.	3-5	14-18 in.	24-28 in.
Horseradish	Root cuttings		24-30 in.	30-36 in.
Kale	1 oz. — 300 ft.	4-5	15-24 in.	24-30 in.
Kohlrabi	1 oz. — 300 ft.	4-5	15-24 in.	24-28 in.
Leek	1 oz. — 150 ft.	1	12-18 in.	24-28 in.
Lettuce	1 oz. — 400 ft.	3-5	12-15 in.	24-28 in.
Muskmelon	1 oz. — 50 hills	5-10	4- 5 ft.	4- 5 ft.
Onion (green)	1 qt. sets — 40 ft.		12-15 in.	24-28 in.
Onion (late)	1 oz. seed — 100 ft.	1	12-15 in.	24-28 in.
Onion (for sets)	1 oz. seed — 25 ft.	1	12-15 in.	24-28 in.
Parsley	1 oz. — 200 ft.	2-3	12-18 in.	24-28 in.
Parsnip	1 oz. — 200 ft.	1	15-18 in.	24-28 in.
Pea	1 pt. to 1 qt. — 100 ft.	2-3	16-30 in.	36-48 in.
Pepper	1 oz. — 1,500 plants	2-3	18-24 in.	36-42 in.
Potato (white)	$\frac{1}{2}$ pk. — 100 ft., 15 bu. per acre		24-28 in.	36-42 in.
Radish	1 oz. — 100 ft.	3-4	6-14 in.	24-28 in.
Rhubarb	Roots		30 in.	36-42 in.
Rutabaga	1 oz. — 200 ft.	4-5	15-20 in.	24-28 in.
Salsify	1 oz. — 100 ft.	2-3	12-18 in.	24-28 in.
Spinach	1 oz. — 100 ft.	2-3	12-15 in.	24-28 in.
Spinach (N. Zeal'd)	1 oz. — 50 plants		30-36 in.	36-48 in.
Squash (summer)	1 oz. — 40 hills	4-8	3- 4 ft.	3- 4 ft.
Squash (winter)	1 oz. — 20 hills	4-8	8-10 ft.	8-10 ft.
Swiss chard	1 oz. — 100 ft.	4-6	15-18 in.	24-30 in.
Tomato	1 oz. — 3,000 plants	4-5	†30-36 in.	36-48 in.
Turnip	1 oz. — 200 ft.	4-5	15-18 in.	24-28 in.
Watermelon	1 oz. — 20 hills	4-8	8-10 ft.	8-10 ft.

* Planted in hills.

† Trained to stakes; without staking, 4 ft. apart each way.

‡ Very hardy: Not injured by hard freezing.

§ Hardy: Not injured by frosts.

¶ Tender: Killed by frosts.

** Very tender: Injured by cool weather.

PLANTING TABLE

PLANTS APART IN ROW	DEPTH OF PLANTING INCHES	HARDINESS	DATE OF PLANTING	TIME OF MATURITY
15-18 in.	8-15	Very hardy ¹	April	3-4 years
2- 4 in.	1-1½	Tender ³	May 10-July 25	40- 65 days
4- 5 in.	1-1½	Tender	June 1-June 25	90-100 days
*2- 3 ft.	1-1½	Tender	May 15-June 15	50- 75 days
3- 6 in.	1-1½	Very tender ⁴	May 20-June 10	60- 75 days
*2- 3 ft.	1-1½	Very tender	May 20-June 1	70-100 days
3- 4 in.	½-1	Hardy ²	April 15-July 10	40- 70 days
15-18 in.	½-1	Hardy	‡February 1-March 15	70-120 days
18-24 in.	½	Hardy	¶May 1-June 1	90-130 days
12-15 in.	½	Hardy	July 1-August 1	80-100 days
2- 3 in.	¼-½	Hardy	April 15-July 10	55- 90 days
18-24 in.	¼-½	Hardy	¶May 15-	90-130 days
4- 6 in.	½	Not hardy— young	‡March 1; ¶Late, April 20	130-180 days
3- 4 in.	¼	Hardy	June 1-15	120-130 days
*24-30 in.	1-2	Tender	May 1-July 1	70-100 days
*2- 4 ft.	½-1	Tender	May 20-June 1	60- 80 days
16-24 in.	¾-2	Very tender	‡§March 15	100-150 days
8-10 in.	½	Hardy	June 1-August 1	45- 90 days
12-15 in.	½	Very hardy	April 15-May 20	180 days
6- 8 in.	½	Hardy	April 15-August 1	50- 75 days
6- 8 in.	½	Hardy	April 15 and August 1	60- 75 days
3- 5 in.	½	Hardy	¶April 15-	130-180 days
8-10 in.	¼	Hardy	April 15 and August 1	45-100 days
*4- 5 ft.	½-1	Very tender	May 20	90-120 days
1 in.		Hardy	April 15	30- 40 days
1 in.	½	Hardy	April 15	130-150 days
Crowded	½	Hardy	April 15	90-100 days
4- 6 in.	¼	Hardy	April 15	60- 90 days
3- 4 in.	¾-1	Very hardy	April 15	120-180 days
½ in.	1-2	Hardy	April 15-May 20	50- 80 days
12-15 in.	¾-2	Very tender	‡§March 15	100-150 days
10-14 in.	3-4	Half hardy	April 15-June 1	80-130 days
1- 2 in.	½	Hardy	April 15-June 1	22- 40 days
24-30 in.		Very hardy	April	1 year
4- 5 in.	½	Hardy	July 1	100-120 days
2- 3 in.	1	Very hardy	April 15	140-150 days
4- 6 in.	½	Hardy	April 15-May 15 & Aug. 1-10	40- 60 days
12-18 in.	1	Half hardy	April 15	60- 80 days
*3- 4 ft.	1	Tender	May 20	60- 80 days
*8-10 ft.	1	Tender	May 20	90-110 days
5- 6 in.	½-1	Hardy	April 15	50- 60 days
†18-24 in.	½	Tender	‡March 1-April 1	100-160 days
3- 4 in.	½	Hardy	April 15 and August 1-15	60- 90 days
8-10 ft.	1	Very tender	June 1	100-120 days

¹In hotbed or greenhouse. Transplanted to permanent place: § June 1. ¶ July 1.

Prepared by John R. Bechtel.

Published in Extension Circular No. 76 of The Pennsylvania State College.

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